EDITORIAL

HOW much luxury tax did you pay last month?

WHO said the country wasn't prosperous? All the $60 seats for the Willard-Dempsey fight are sold already.

GOVERNMENT price regulation is definitely in the discard. The Victory Loan is oversubscribed and out of the way. What are you waiting for now? Start something.

COUNT VON BROCKDORFF-RANTZAU, the head of the German peace delegation was a little weak in the knees when he appeared at Versailles, but his cheek seems to have been as strong as ever.

AEROPLANES were used in making observations of a solar eclipse on May 29. The particular object was the taking of photographs above the cloud-zone, which, it is expected, will give better results than the ordinary methods.

IN spite of the fact that munitions are no longer being sent to Europe, exports from the United States continue to increase. In April the total was $715,000,000, nearly $100,000,000 more than in January of this year, the previous high month. The April total is greater than that for any entire year preceding 1880.

"COMPLETELY cured me of any leaning toward Government ownership" is the testimonial that Mr. Charles Piez issues regarding his recently completed course as general manager for the Emergency Fleet Corporation. Is it going to be necessary to furnish all government-ownership advocates with a similar lesson?

SHIP contracts are not to be cancelled arbitrarily by the United States Shipping Board, but Pacific Coast builders are warned that they must increase efficiency and lower costs. Yet it was largely as a result of Government intervention that the 44-hour week was conceded in the local yards, in spite of union agreements for a 48-hour week. Can you beat it?

THE faithful 'tin derby', which served so well on the battlefields of France, has now been drafted for peace service. The War Department suggests that the helmets can be used to advantage in occupations where there is danger of head injuries from falling objects. A hot rivet landing on a helmet may make some returned soldier beneath it think of old times, but it will simply bounce off and go on its way rejoicing without doing any damage.

THE Pacific Coast District Metal Trades Council, representing unions in the shipbuilding centres of the Pacific Coast, held meetings in Oakland during the first two weeks of May. The standing of this organization is hard to determine. It has not been recognized by the American Federation of Labor as the Federation's policy is against recognition of an organization representing more than one State. According to newspaper accounts, the Oakland and Seattle radical element are in control of the new organization. It is stated that the agreement drawn up for presentation to the employers calls for the 44-hour week and a 20% increase in pay in all crafts, and provides for the creation of an adjustment or conciliation board. Resolutions were adopted endorsing the six-hour working day and the liberation of all political prisoners. It is stated that a conference with employers will be held July 15 and that a strike will be called July 21 unless the employers enter into a satisfactory agreement. So far the employers have given the Pacilc Coast council no recognition whatever.

HONORS in the flight across the Atlantic have fallen to the American Navy. Viewed simply as a sporting event, the exploit of the crew of the NC-4 fires the imagination. As a scientific and mechanical achievement it will stand as one of the most important of this generation. Our pleasure in the success of our own countrymen does not diminish our sympathy for Hawker, the gallant Australian who so nearly 'beat us to it', nor our joy in the fact that both he and his companion were rescued. Considered merely as a non-stop run, theirs was a remarkable achievement, and the distance traversed before their mishap was almost as great as the distance between the North American coast and the Azores as covered by the NC-4. It is interesting to note that a hundred years ago to a month, the 'Savannah', the first steamer to cross the Atlantic, started from the port of Savannah. The 'Savannah' would hardly be called a steamer in these days, since she depended principally on sails, and used her engines mainly when the wind failed. The inefficient wood-burning engines of those days made such a course practically imperative, provided the entire cargo-space was not to be given up to fuel-bunkers. It was not until 1838 that another steamer ventured to make the crossing. In the meantime mechanical progress had been such that sails became less and less important, although it is only within the last twenty years that steamship designers have discarded them entirely.

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Victory Loan Oversubscribed

As predicted in our last issue, the Victory Loan was oversubscribed. If there was any locality that did not go over the top, we have not heard of it. The indications are that the burden upon the banks will be comparatively small and that therefore capital will be available for the financing of business enterprises, the best news since the signing of the armistice. This is the last of the great drives, by which billions have been raised for carrying on the War, and hundreds of millions given outright for war work. The unselfish devotion of those that gave both money and service without stint has no parallel in the history of the world. The emergency that called it forth will, we hope, never occur again but there is plenty of outlet for that devotion in the work of reconstruction.

Employers 'Scab' on Each Other

In March, on account of unsatisfactory conditions in the metal market, the mine-owners in the Park City and Tintic districts, Utah, cut wages 75 cents per day. On May 9, over two months after the reduction, the miners struck, ostensibly at least, for a restoration of the old rate. Although most of the miners in the district are union men, the strike was not sanctioned by any of the national miner's unions, and it is locally attributed to I. W. W. agitators. Now comes the employers' part. About the same time the cut in wages was made in Utah, a similar reduction, but of $1 per day, was made in the Coeur d'Alene district in Idaho. On May 20 Idaho mine operators announced an increase in wages of 50 cents per day. This is something they have a right to do, but whatever the intention may have been, the actual result will be to attract many Utah miners to Idaho, where there is a shortage of labor. Lack of solidarity among employers is one of the most potent causes of the present unsatisfactory industrial situation. The illustration has been taken from the mining industry, but this is no indication that a similar example could not have been found in the metal trades. When employers are able to get together and stay together, and then treat fairly with employees that get together and stay together, the millenium may not have arrived, but industrial peace and efficient production, at least, will be attainable. Until that time arrives, there is little hope of either.

The Metric System Again

A systematic propaganda is now under way for the adoption of the metric system in this country. Among other indications we may mention the circulars being sent by the so-called 'World Trade Club' of San Francisco, to what is evidently an extensive mailing list. These circulars contain two nice little stamped envelopes, one for Woodrow Wilson, and one for Lloyd George (Clemenceau and Orlando are ruled out, we suppose, because they belong to metric-system countries), and the recipient is supposed to write and urge these gentlemen to put the metric system through without delay. We will not take the time to discuss the arguments set forth in the accompanying circular. Most of them would be laughable were it not for the fact that the claims may make an impression on the minds of those who do not know any better. Perhaps if the change to the metric system could have been made a hundred years ago, before the development of modern machinery and standards, it might have been worth while. But, while all of the advantages claimed by metric-system advocates are exaggerated and many are doubtful, utter confusion during the years of transition is certain. Our sympathy goes out to the mechanic flat on his back underneath some machine trying to put a 25-millimetre nut on an inch-bolt, and stripping threads all the way down. Another aspect of the case also deserves mention. While we have no doubt that the metric-system advocates are entirely conscientious, there are few things that would be a greater help to the German manufacturer, now that France and Belgium are temporarily crippled, than to have his other two great competitors, Great Britain and the United States, plunged into the confusion caused by the attempt to change standards.

How to Settle Disputes

Admiral William S. Sims, the man that 'delivered the goods' has broken his usual silence long enough to tell how co-operation between the Army and the Navy was maintained. His own words tell the story so well that we quote them in full: "Our principal business was to get the troops and provisions across to the other side. Now there was an army man and a navy man in command in every port, and there was plenty of chance for friction, but 'Jack' Pershing and I decided that there should be no friction, but that we would work together like just two ordinary decent Americans. Whenever we heard of trouble between two officers we did not waste time and energy carrying on elaborate investigations to prove that the other one was wrong, but we yanked them both out, regardless of who was in the right, and put two others in. We did not have to do it often, but we did it often enough to show that army and navy officers must get along together without friction." It is probable that this system worked some injustice and that occasionally wrong decisions were made on matters of policy, but the work was done. This system was a war-time measure, although unfortunately the same policy has not been followed in other Government departments either before or since the signing of the armistice. However, war-time measure or no, a little dose of the same policy would serve as a tonic in ordinary business and in other activities. When a man learns that inability to get along with his associates, whether they be employers, employees, customers, dealers, creditors, or debtors, is in itself considered as evidence of a certain

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measure of incapacity, he usually discovers a way to get along with them.

Failure of Stabilization Admitted

After a stormy existence, culminating in series of acrimonious statements issued by the respective partisans of Mr. Peek and Mr. Hines, the Industrial Board has disbanded. This action definitely puts a quietus on all ideas of Government price-fixing, price-stabilization, price-suggestion, or whatever you may care to call it, for steel or any other staple. Soon after this event, the United States Railroad Administration opened bids for supplying 200,000 tons of rails. With the exception of one concern, whose figures were higher, all of the bidders quoted the same figures as those previously determined by the Industrial Board, namely, $45 per ton for bessemer, and $47 for open-hearth rails. In accepting these bids and dividing the orders between the six companies bidding, Mr. Hines, on behalf of the Railroad Administration, issued a statement that the orders were placed 'under protest' and with 'emphatic disapproval of the prices and the manner in which they were established.' It is hard to see where anyone is better off than they were two months ago. Mr. Hines has been compelled, for the time being at least, to accept the prices against which he protested. The steel producers have cut prices, probably a little lower than they would have if the price-fixing plan had not been proposed. They have, temporarily at least, been able to hold their ranks firm on these prices, but it remains to be seen whether or not quickened demand will be sufficient to maintain prices at this level. The trade in general has had several weeks of uncertainty with no compensating advantages. Nevertheless, we reiterate our former contention that the price-fixing plan did not have a fair trial and might have been useful had there been more cooperation among those affected. However, the milk has been spilt, and many people say it was sour anyway, so let us not cry over it too long.

The White-Collar Job

In another column appears a discussion of the apprentice question by a veteran foundryman, together with a summary of the opinions of certain high-school boys regarding foundry work. While Mr. Hedley's article and the boys' opinions are concerned with the foundry, both apply, in part at least, to other branches of the metal trades. The answers given by some of the boys may seem ridiculous, but the state of mind that they indicate is serious, and calls for earnest consideration. The question cannot be dismissed by saying that the boys are foolish. That would be like blaming the defects of a badly-constructed machine upon the raw material used, rather than upon the methods of manufacture. If the only really important finished product that this community, or any other, turns out, namely, its men and its women, fail to come up to specifications, the fault is with our institutions, not with the raw material. In this particular case, the institutions principally to blame are the school and the shop. It has long been recognized that our educational system inclines boys away from the trades and manual labor in general and toward clerical work and other lines where the hands can be kept clean and soft. The polytechnic schools were designed to correct this tendency. Evidently, they have not done so. In fact, they have failed so completely that one boy even believed such a school was a place to learn a profession, not a trade. Again, we say, "Don't blame the boy. Blame the institution." If the Federal Board for Vocational Education can lead and direct the movement for changing the condition already outlined, which will require something more than the mere changing of a few courses, it will have amply justified its creation. On the other hand, there is plenty of opportunity for reform in the shop. Most work in the metal trades is necessarily laborious, and certain features of it are necessarily disagreeable. That, however, is no reason why the work should be made more laborious and more disagreeable than is necessary. When our educational systems are so arranged that the boys leaving the schools consider any work worth doing and worth doing well, and when our shop systems are arranged to conserve the human equipment as much as the machinery, we will not need to bother much about the apprentice question.

The Metal Trades Association Convention at Seattle

By W. H. THILLE

THE Thirteenth Annual Convention of the United Metal Trades Association held at Seattle, April 25 and 26, was attended by 125 delegates from various cities in the North-West, including Seattle, Portland, Vancouver, Victoria, Tacoma, Spokane, Bellingham, and smaller communities.

In opening the convention President Johnson characterized the year just closed as an eventful one in the affairs of the United Metal Trades Association, beset with many difficulties.

He reviewed the proceedings of the Shipbuilders' Labor Conference held in Philadelphia last August. He also discussed the Seattle general strike. He denounced Bolshevism, and recommended education as the only certain remedy for this condition. He recommended the adoption of a rule that the members of the Association when purchasing castings, forgings, and such other materials as may be manufactured by concerns eligible for membership, patronize as far as possible Association members in good standing, and further that the secretary be instructed to mail to the membership every

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month a corrected list of the members in good standing for each district. He also recommended that each district secretary be instructed to establish an intelligence bureau, for the purpose of keeping informed regarding work or contracts in the various industries in the Association, and to keep the membership posted as to such available business.

He recommended serious consideration of profit-sharing, and gave as his opinion that this practice may well be of greater injury than benefit, unless some sound feasible plan can be devised that would be followed uniformly by all the members of the Association.

Mr. A. G. Labbe, chairman for the Oregon district, reported progress in co-operation and organization during the year just completed, as shown, among other things by the fact that seven new members have joined the Association in the Oregon district without solicitation. Mr. Labbe discussed the scarcity of skilled mechanics, the increase in wages, and the decrease in the productive efficiency of the individual. Employees demand wages commensurate with their standards of living, and at the same time talk of limiting production, forgetful of the fact that only by a tremendous increase in production is it possible to get the full measure of the desired benefits. A recent Government report showed that the percentage of both turnover and absentees in Portland is low as compared with other cities on the Pacific Coast.

There has been some agitation for a 44-hour week. Where the volume of work justifies, all shops are operating on a basis of 48 hours a week, although where tonnage will not permit a full week's operation, some foundries are running only five days. The future policy will depend on volume of business and on production costs. There is no indication, however, that it will be possible to reduce the working period below that now in effect and in all probability it will be necessary to increase it somewhat in order to compete with Eastern shops working 54 to 60 hours per week.

In his report as chairman of the Washington district, Mr. John Wallace discussed the Seattle strike. He characterized the outlook for business in the metal trades during the period of readjustment as not very encouraging. He reported increased membership and general co-operation among members in the Washington district.

Mr. E. V. Young, chairman of the Vancouver, B. C., district reported closer co-operation and organization in his community. He discussed the labor problems with which the Association was confronted and the possibility of a solution of these difficulties in view of the fact that the Canadian government is taking a hand in the matter.

In a comprehensive report on general activity and accomplishments, Mr. J. B. Jones, general secretary, mentioned the increase of the membership of the United Metal Trades Association from the addition of the Vancouver, B. C., district. He spoke of the difficulty of competing with Eastern shops working longer hours and paying lower wages. In speaking of labor problems of the future, he urged that superintendents, foremen, or sub-bosses should not be members of any labor union, since they are direct representatives of the employer and cannot do justice to him and be active members of the union at the same time.

The principal speaker at the Convention Banquet was Mr. D. V. Halverstad, attorney for the Employer's Association of Seattle as well as the United Metal Trades Association, who advocated constructive measures of dealing with Bolshevism such as treating with employees on reasonable terms, establishing good working conditions, taking an interest in employees' welfare, assisting the wage-earner to reduce the cost of living, and introduction of profit-sharing systems.

Generally, in the northern district, with the exception of the steel shipbuilding plants, the shops are running far below normal capacity. Naturally those firms that are still working on uncompleted war contracts are busy. Many foundries and machine-shops are idle because of the cancellation of the wooden shipbuilding contracts. Some shops in Seattle and Portland are conducted strictly on the closed union-shop basis, while others are open-shop, and others again are closed non-union. This condition of limitations and restrictions in the hiring of labor seems to be working a serious hardship on the northern community. One closed non-union shop in Seattle employs about 300 men. The best of relations exist between the employer and his men. Production is high. At the end of last year this employer shared a little over $12,000 as a bonus with his men. The difference in output between some shops operating on the piece-work basis and closed union shops is remarkable. In a closed union shop the output per man was 24 brake-shoes, in a closed non-union shop the output ranged as high as 125 per day.

The northern community is working under the Macy wage scale, but as a general rule, molders and core-makers are receiving seven dollars or more per day. The employment of men is conducted almost entirely through the Association office. A demand for the Saturday half-holiday has been made in Seattle and Portland. Some foundries shut down all day Saturday, while others keep open all day. Working half a day is generally discouraged among employers, but in the absence of specific instructions from the Association, the employers act independently in this matter.

The 'Castings Price Bulletin' and 'Cost Card' prepared by the California Foundrymen's Association received frequent commendation. Great credit is due Mr. John E. Hax and his associates for their work in preparing these lists.

The North-West is to be complimented on the wonderful spirit that it maintains in spite of the complete cancellation of the wooden shipbuilding program. This was a serious setback, but they are game and are now looking forward to the normal demands of peace times. Closer relations in the metal trades between California and the North-West would be of advantage to both sides, and when the time becomes ripe for a Pacific Coast Metal Trades Association, good timber for officers will be found in the North as well as in California.

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Electric-Steel Furnaces in California

PART I—THE HEROULT FURNACE

THIS is the first of a series of articles on electric furnace practice in California. Other types of electric furnace will be discussed in succeeding articles.

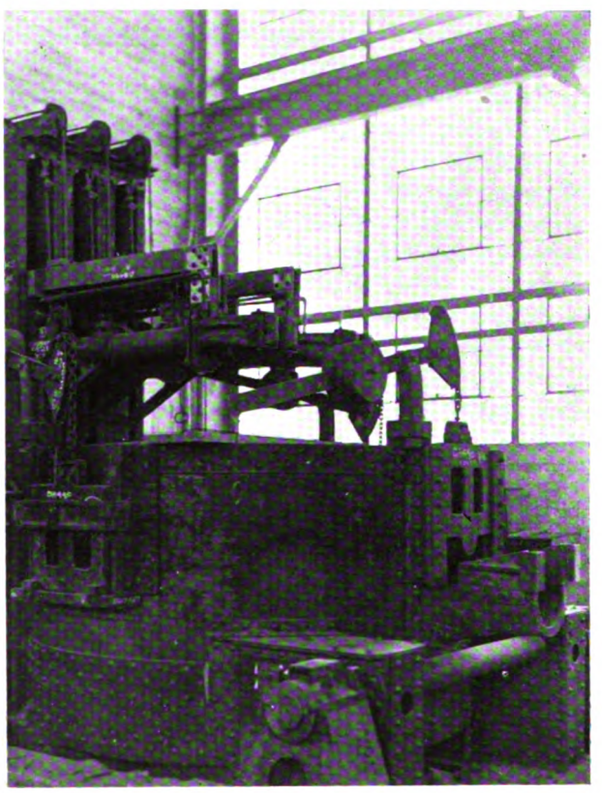
WHILE the commercial success of electric furnaces for iron and steel making is a comparatively new thing, the use of electrically generated heat for metallurgical work was suggested many years ago. The first patents were granted in France in 1853 to Pichon, but it was not until 1878 that Siemens built the first practical furnaces. Steel was actually made in these furnaces, but the high cost of current in those days made the expense prohibitive. With the development of hydro-electric power and also of efficient steam electric generating machinery, this objection was removed in part, and in the late 'nineties, improved furnaces began to be developed on a commercial scale, the earliest being the Stassano, the Heroult, and the Kjellin furnaces. At first, the electric-furnace was employed simply for making high-grade steels that were formerly made by the crucible process, and this is still the principal field, but under special conditions the electric furnace may now be considered the competitor of the open-hearth furnace, particularly when the superior quality of the product is considered. The number of electric furnaces in the iron and steel industry increased materially during the War, and it is estimated that there are now more than 800 in the world.

The electric furnace process is less expensive than the crucible process, which is the only other process that produces steel of a comparable quality. In general, on account of the cost of current, it is more expensive than the open-hearth or other processes. Some of the advantages that frequently outweigh this greater cost are as follows:

1. Economical production (outside of cost of current).
2. Ready and easy means of exact control.
3. Ability to produce any slag and temperature desired.
4. Fusion effect in a neutral atmosphere.
5. Rapidity of operation.
6. Ability to produce a high quality of steel (given the proper treatment) from inferior materials.

The Heroult is the most popular electric furnace in this country. Of the 330 furnaces in the United States and Canada listed by 'The Iron Age' in January 1919, 163 or nearly one-half were Heroult furnaces. The estimated number at the present time is nearly 200. The hearth is similar to that of an open-hearth furnace, and may have either an acid or a basic lining. With an acid lining the phosphorus is not removed, so that raw material relatively low in phosphorus is required unless high-phosphorus castings are not objectionable. The principal materials used for a flux are sand, fluorspar, and, in some cases, lime to reduce the acidity of the slag. For a reducing medium coke-dust, petroleum-coke, or some other form of carbon, except graphite, are used.

With a basic lining it is possible to remove both the sulphur and the phosphorus. This is accomplished by first producing an oxidizing slag to eliminate the phosphorus and then removing this slag, and adding a reducing slag to remove the sulphur and to de-oxidize the steel. The principal flux used is burned lime and occasionally fluorspar to thin the slag.



FURNACE UNDER CONSTRUCTION AT PLANT OF AMERICAN MANGANESE STEEL CO., SHOWING ELECTRODE-HOLDERS, DOOR-OPENING MECHANISM, AND OTHER PARTS.

In making alloy steels of all kinds the necessary additions are made directly in the bath, so that a minimum amount is required for the desired result, there being no loss from oxidation.

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The Heroult furnace uses three-phase current at 100 volts and any commercial frequency from 25 to 60 cycles, the regular voltage furnished by the central station being stepped down by a transformer at the furnace. There are three electrodes, all entering the furnace vertically through the roof. Amorphous carbon is preferred to graphite as a material for electrodes, because it is cheaper per ton of steel melted and does not break so easily as graphite, and furthermore the larger carbon electrodes used produce a so-called 'umbrella effect' on the roof, protecting it from the intense heat of the arc. These electrodes are made in sections so that the new electrode screws into the old one, and there is no loss from pieces of electrode too short to use. The carbon electrodes are molded from calcined anthracite or other carbon material and by-product tar. The average amount of electrodes used per ton of steel is 40 lb. With basic furnaces the average amount of lime used per ton of steel is 80 pounds.

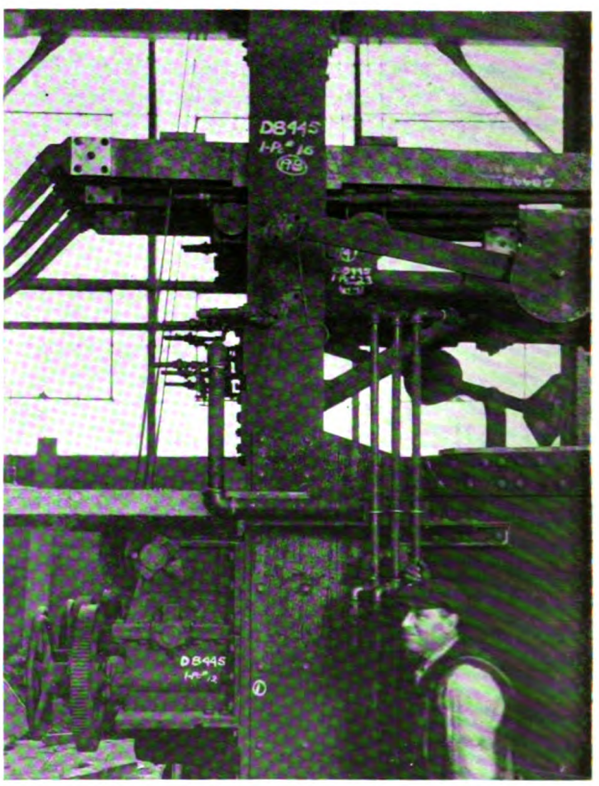
The furnace is fitted with both hand and automatic control to give the proper length of arc for varying load conditions. There are two types of automatic-control mechanism, one furnished by the Westinghouse Electric & Manufacturing Co. and the other by the General Electric Co. Both types give good results in practice. The Westinghouse mechanism is called a Thury regulator, and was originally developed in Switzerland. Contact-making ammeters and standing contactors are used by the General Electric Co. With a furnace using a basic lining, the full load will be required during the melting-period for about 2½ hours. After the steel is melted, about a 60% load will be needed during the refining period, dropping to about 25% just before pouring. The total time for a heat will usually be from 4 to 4½ hours. With the acid process, on account of the lesser degree of refining accomplished, the heats can be run much quicker, but the quality of the steel will not be so good, given the same quality of material charged. The electrodes are set in bronze holders, which are water-cooled. Pouring is accomplished by tilting the entire furnace, the tilting mechanism being operated by an electric motor. For a 6-ton furnace a 25-hp. motor is required and the counterweight weighs 18 tons. A furnace of this size requires a 1500-kva. transformer and uses 17-in. carbon electrodes.

For lining, 85,000 lb. of refractory brick is required. For a basic furnace, a 16-in. lining of magnesite brick is used for the bottom and a 9-in. lining of silica brick for the roof. Occasionally 15 in. of chrome brick, which is neutral, is used at the slag-line.

Heroult furnaces are made in the following sizes: 1, 2, 3, 6, 10, 20, and 30-ton. The smaller furnaces are usually charged with cold scrap, while the large ones are generally operated with hot metal that has been melted in some combustion process, thus combining the advantages of the usually cheaper melting by combustion furnaces with the greater refinement obtained with the electric furnace. Some furnaces are operated on the so-called triplexing process, namely, first, the blast furnace, next, the bessemer or the open-hearth furnace, and finally the electric furnace.

Some of the newer furnaces have a double-voltage control, which permits a rather high voltage, 120, for instance, to be used during the melting period, and a lower voltage, say 85, for the refining period. Heroult furnaces have a high power-factor, a good load-factor, and a balanced three-phase load, which furnishes an inducement for a good power-rate. For ordinary conditions, operating on cold scrap, 600 to 700 kilowatt-hours of energy are required per ton of steel.

Some of the companies using Heroult furnaces in the



ANOTHER VIEW OF THE MANGANESE COMPANY FURNACE

East are the following: The Armstrong-Whitworth Co., a Canadian concern, makes tool-steel and machine-tools in this way. The Harrow Spring Co. uses electric steel for springs and other special steels. Disston & Sons use electric steel for saws and files. The manufacturing processes of the Timken Roller Bearing Co. result in its having to handle a large quantity of turnings, borings, and similar undesirable scrap. This is compressed in a machine, melted in the electric furnace, and the product used in making high-grade roller-bearings. It is interesting to note in this connection that in making the Rolls-Royce automobile, perhaps the highest-priced car on the market, electric steel only is used, while at the other extreme, 70% of the steel used in the humble Ford is made in the electric furnace.

In California at the present time, the following Heroult furnaces are either in operation, under construction, or about to be installed:

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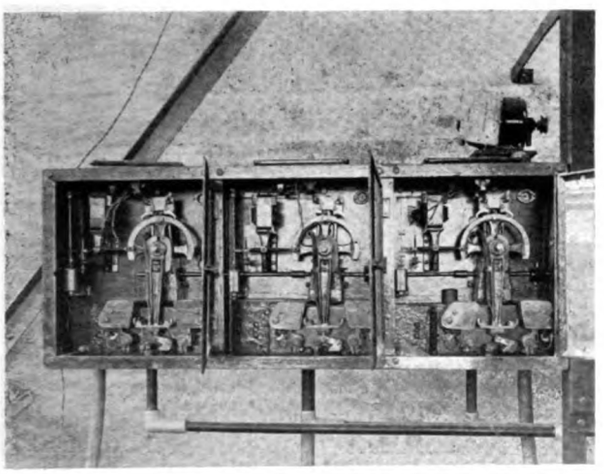
furnace at its plant. As this is the only Heroult furnace now actually in operation in the vicinity of San Francisco, a brief description of the practice followed will be given.

The furnace is used for making ordinary steel castings of whatever proportion of carbon is required. Castings of all sizes up to one ton are made, principally tractor, railroad, and automobile work. The furnace has not been used for making special alloy steels. The company also makes gray-iron and semi-steel castings by the ordinary methods.

Power is obtained from the Western States Gas & Electric Co., the line-voltage being 2200, and furnace voltage 110. The furnace is a regular three-phase, three-electrode installation, and is charged through a single



THURRY REGULATORS AT MANGANESE COMPANY FURNACE

side-door. Like the other electric furnaces in California, in operation and under construction, a cold-scrap charge is used. Unlike the other furnaces, however, an acid bottom is employed.

The furnace was put in operation in June 1916, and has been in steady use ever since. The average melting-time is $2\frac{3}{4}$ hours, three or four heats being poured per day. From 3200 to 3500 lb. of ordinary steel scrap is used per charge, the material providing its own flux. If the carbon content of the scrap charged is high, and a mild-steel product is required, sufficient iron ore is added to produce the desired result. On the other hand, if castings are needed with a higher proportion of carbon than the available scrap will provide, old electrodes or some other form of carbon are added to the charge. With these exceptions, a fairly uniform melting practice is followed. Pouring from this furnace is illustrated on the front cover of this issue.

Besides a large amount of local work, castings from this furnace are shipped to practically every part of California, including such widely separated points as Eureka and Los Angeles.

The General Motors Corporation, which owns the Samson Sieve Tractor Co., purchased a 6-ton furnace in 1917, which was to have been used for making steel castings at its plant at Stockton. Since then the general plans have been changed and the Samson factory will be used simply as an assembling-plant. Consequently, this furnace was not put in operation. It has, however, been sold to the Best Steel Casting Co. and will be used at the Oakland plant of the latter company for making steel castings.

A 2-ton furnace is now being installed at the plant of the American Manganese Steel Co. under construction in Oakland just north of the Southern Pacific mole. This will be used for making manganese-steel castings. The Southern Pacific Co. has purchased a 6-ton furnace for its Sacramento shops. This will be used for steel forging-ingots and steel castings for the company's own needs. The Southern California Iron & Steel Co. has bought a 6-ton furnace for its plant at Los Angeles, which will be used on commercial work for steel castings.

All of the above mentioned furnaces, including the one at the Monarch Foundry, were manufactured by the American Bridge Co., which, as a subsidiary of the United States Steel Corporation, controls the Heroult patents in the United States. In addition, there are five furnaces in Los Angeles and the vicinity that were built under license from the United States Steel Corporation by the companies operating them. The reason for this is that at the time when these furnaces were ordered, the American Bridge Co. plants were so busy on all kinds of war work that early deliveries were impossible. The temporary expedient was therefore adopted of permitting construction, under license, of furnaces by the companies themselves. Two of these furnaces, a 1-ton and a 3-ton, are at the plant of the Warman Steel Casting Co., and are used on commercial work for steel castings. The Llewellyn Iron Works has a 3-ton furnace at its plant at Los Angeles. This is used mainly for making forging-ingots for the rolls and other equipment in the company's rolling-mill, and for other requirements of the company itself. Finally, the Union Tool Co. has a 1-ton and a 3-ton furnace, also for steel castings.

No mention has been made in this article of the furnaces of the Noble Electric Steel Co. at Heroult or the Pacific Electro Metals Co. at Bay Point, since none of these are, strictly speaking, Heroult furnaces, although there are many points of resemblance.

PAT, just landed, inquired of a policeman where St. Luke's Hospital was. The policeman replied that he did not know where the hospital was, but would tell him how to get there. He said: "Go down this street two blocks, turn to the left and go another block. There you will find Mike O'Reilly's saloon. Go in and Mike will give you a hearty greeting, ask you if you just came over, and if you went to see the Pope before coming to America, and you will answer, 'To Hell with the Pope!' and when you wake up you will be in St. Luke's Hospital."—'The Yellow Strand'.

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PANORAMIC VIEW

California Tractor and Implement Exhibit at Sacramento

THE annual exhibition of the California Tractor and Implement Association was held near Sacramento, May 6 to 11. The exhibition grounds comprised a 600-acre field about six miles north of town. The weather during the week was mild but not excessively hot. The ground was level or nearly so and the soil was a typical Sacramento valley loam. The dry weather had caused this to bake fairly hard, so that tractors and implements performing satisfactorily could safely be expected to 'stand up' well under the ordinary conditions of dry plowing. In this respect, the 1919 show furnished a better test of the farm machinery than the one at Davis last year, where the soil conditions happened to be particularly favorable to easy plowing.

An examination of the tractor exhibits shows that the old battle between the 'round-wheel' and the 'tracklayer' types of traction still continues merrily, although the round-wheel men, as a rule, concede that for certain kinds of service the tracklayer type is better. It might be mentioned in passing that the soil conditions already noted were favorable to the round-wheel type of tractors, since there was no sand or soft ground of any kind, and therefore no trouble in obtaining traction. This, of course, applies to the plowing rather than to the disking and cultivating. In the strife between gasoline and kerosene as fuel, however, kerosene seems to be gaining, although several companies hold that, in spite of improved carbureters, the disadvantages of kerosene more than outweigh the reduction in cost. Perhaps the most noticeable feature of this year's exhibit from the manufacturer's standpoint is the increased use of heat-treated special steels for parts subjected to unusual wear and strain. Other features are improvement in methods for cleaning the air before admitting it to the carbureter, and also of pre-heating the air, the latter device becoming important with the use of keresone. The air-cleaning systems, however, still leave much to be desired, and this remains one of the most promising fields for research work in tractor design. Three-point suspension of the engine has become practically universal.

Each tractor manufacturer and several of the implement-makers had a camp at some point on the four sides of the field, while the makers of accessories and motor trucks were grouped in one large tent near the entrance. Several lectures on such subjects as 'Lubrication', 'Farm Mechanics', and 'Soils' were given during the week. Tests of drawbar pull and other characteristics of the tractors were made under the direction of J. B. Davidson, professor of agricultural engineering at the University Farm School at Davis. Among the tractor exhibits were the following:

The Moline Plow Co., of Moline, Illinois, showed its Model D Universal Tractor and various attachments for plowing, mowing, cultivating, etc. This machine is rated at 9 hp. on the drawbar and 18 hp. on the belt. It is a 'two-wheel' machine intended to be used with the attachments made by the company. This design makes possible a compact working unit easily operated by one man. The carbureter is one of the few designed to burn gasoline. The tractor is of the round-wheel type.

The J. I. Case Threshing Machine Co., Inc., of Racine, Wisconsin, featured particularly its 10-20 tractor, but also showed its 15-27 and 20-40. All these machines burn kerosene and are of the round-wheel type. The company also exhibited threshing machinery, plows, and disk-cultivators.

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OF FIELD

The Cleveland Tractor Co., of Cleveland, exhibited its 12-20 machine. This is of the tracklayer type and uses either kerosene or distillate. Its small turning-radius renders it especially adaptable for orchard work.

The 'Bearcat' tractor is a relatively new machine manufactured for the W. J. Burt Motor Car Co. of Los Angeles. It is a 10-20 tractor of the round-wheel type and burns kerosene.

The Butler-Veitch Co., of Oakland, exhibited the Fageol 'walking' tractor. This machine, while of the round-wheel type, differs from other tractors of that class in having no tire and rim in the ordinary sense of the word on the rear wheels. Instead, the tread is composed of a series of radial triangular points that give good traction no matter how adverse the conditions may be.

The De Laval Dairy Supply Co. exhibited the Lauson tractor, manufactured by the John Lauson Manufacturing Co., of New Holstein, Wisconsin. This is a 15-25 machine of the round-wheel type and burns kerosene.

The Wallis 'Cub Junior' is a 15-30 tractor of the round-wheel type. One particularly noticeable feature of the machine is its light weight, only 3000 lb., which is considerably less than most tractors developing the same power. In the same tent were exhibited the plows and cultivators made by the J. I. Case Plow Works, of Racine, Wisconsin, which also handles the Wallis tractor.

The International Harvester Co. was represented by three tractors, the 8-16, the 10-20, and the 15-30, all round-wheel kerosene-burning machines. The company also exhibited a large assortment of other agricultural machinery.

The Bates 'Steel Mule', manufactured by the Bates Machine & Tractor Co., is a 12-20 kerosene-burning machine of the tracklayer type.

The John Deere Plow Co. exhibited the Waterloo Boy tractor, which is a 12-25 kerosene-burning machine of the round-wheel type. In the same tent the John Deere company exhibited its line of plows and other cultivating machinery. The Deere plows and cultivators were extensively used in the field tests behind various types of tractors and the results were satisfactory in every respect.

The Monarch Tractor Co., of Watertown, Wisconsin, exhibited three machines, a 6-10, a 12-20, and an 18-30. These are all kerosene-burning machines of the tracklayer type.

The Whitney Tractor, exhibited by the Pacific Whitney Tractor Corporation of Los Angeles, is new to California, although it has been sold extensively in the East. It is a 9-18 machine with round wheels and burns gasoline. The Advance-Rumley company exhibited a 12-20, a 16-30, and a 20-40 tractor. The Bean Spray Pump Co. featured its small tracklaying tractors designed especially for orchard work. The R & P Tractor Co., of Alma, Michigan, exhibited its 12-20 round-wheel machine.

The Avery Co. exhibited its full line of tractors, comprising the following sizes, 8-16, 12-25, 14-28, 18-36, 25-50, and 40-80. These are all kerosene-burning round-wheel machines. A feature of the Avery exhibit was a 24 by 24-in. block of wood about 3 ft. long. One of the operators had nothing at all to do during the entire day but make one wheel of a 25-50 machine mount that block of wood and drop down on the other side. The relative ease with which this was done testified to the power, tractive efficiency, and stability of the machine. The Avery Co. also exhibited threshing machinery.

The Fordson tractor is a 12-20 kerosene-burning machine of the round-wheel type. The All-Work tractor made by the Electric Wheel Co. of Quincy, Illinois, is a 14-28 kerosene-burning machine of the round-wheel type. The Dauch Manufacturing Co. of Sandusky, Ohio, exhibited two models of the Sandusky tractor, one 10-20 and the other 15-35. Both of these are kerosene-burning round-wheel machines. The Averill Machinery Co. exhibited the Russell line of kerosene-burning round-wheel tractors, also threshing machinery. The Buckeye Manufacturing Co., of Anderson, Indiana, exhibited its Trundaar tractor. This is a tracklaying machine, rated at 20-35. The Emerson-Brantingham line of farm-machinery was represented by its 9-16, 12-20, 20-35, and 40-65 tractors, as well as a number of plows, and other

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equipment. The tractors are kerosene-burning round-wheel machines. The new model 30-X of the Samson Sieve-Grip tractor, now manufactured by the General Motors Co. was the centre of considerable interest.

The three principal Californian companies making large tracklaying machines, the C. L. Best Gas Traction Co., the Yuba Manufacturing Co., and the Holt Manufacturing Co., were each well represented. The Best company showed a 25 and a 75 machine. The Yuba company showed three models, the 12-20, 20-35, and the 40-70. The Holt company exhibited its 45 and its 75 machine. Besides its tractors, the Holt company showed harvesting machinery, including a mammoth combined harvester with a 55-hp. engine, 50-in. separator, 40-in. cylinder, and a 24-ft. header.

Many of the plow manufacturers, besides having their plows and cultivating machinery in action in the field-tests of tractors, maintained separate tent exhibits, among them being the Oliver Chilled Plow Works, the H. C. Shaw Co., and H. G. Knapp & Son, as well as several companies already mentioned. The Baker, Hamilton & Pacific Co. had an exhibit of many kinds of agricultural machinery, including plows, disk-harrows, clod-mashers, mowing-machines, and other equipment. The Schmeiser Manufacturing Co., of Davis, exhibited its heavy land-leveling machinery, which, used with a tractor, does most of the work formerly associated with the fresno scraper and the faithful mule. The Killefer Manufacturing Co., of Los Angeles, exhibited its line of heavy plows, subsoilers, gopher-plows, and other machinery for deep tillage and drainage.

In the main tent almost every make of motor truck was exhibited, including the Auto Car, Clydesdale, Packard, Fageol, Reliance, G. M. C., Garford, Velie, Moreland, Pioneer, Patriot, Nash, Federal, Signal, Oldsmobile, International, Republic, Kleiber, White, Chevrolet, and All American. The makers of lubricating oils were also well represented, including the Standard Oil Co., the Union Oil Co., the Tide Water Oil Co., the Swan & Finch Co., and the Valvoline Oil Co. Besides its exhibit in the main tent, the Standard Oil Co. also had two service stations on the grounds. The importance of manganese-steel in tractor construction for tracklayer treads, gears, pinions, and many other parts was shown in two exhibits, one by the American Manganese Steel Co. and the other by the Taylor-Wharton Iron & Steel Co. An interesting exhibit from the standpoint of machine-shop practice was that of the Hansen Machine Works, of Sacramento, which comprised a Heald grinder actually at work regrinding a tractor-engine cylinder. Other exhibits of more than ordinary interest included that of the Western Electric Co. showing an electric light plant for farm or other detached service, driven by an internal-combustion engine, of the Fairbanks-Morse Co. showing some of its engines, pumps, and motors, and of the Torbenson Axle Co. showing its special internal-gear drive.

Use of Automatic Machinery in the Manufacture of Drake Lock-Nuts

IN almost every city or town in the manufacturing districts of the East there are from one to a half dozen or more screw-machine plants, some of them very large. These plants have been the backbone of quantity production of various articles and have helped materially to place the United States in the lead in many manufacturing industries. The first plant equipped entirely with full automatic machinery to be established in San Francisco is that of the Drake Lock-Nut Co. Its product, the Drake lock-nut, was developed there and is shipped to practically all parts of the world.

The Drake plant is equipped with four-spindle, full-automatic National Acme screw-machines and single spindle, heavy type Cleveland automatic screw-machines. One skilled operator runs from two to four of these machines after they are properly adjusted, this adjustment being first supervised by an expert tool-maker.

The Drake lock-nuts are machined from solid hexagon-steel bars rolled to size. On the four-spindle National Acme automatic screw-machines there are four hexagon-steel bars carried in four trucks which are in a revolving head. Opposite the bar-end is the turret which carries four tools, thus permitting four different operations to go on at one time as the turret-head automatically approaches the end of the revolving bars.

After an operation is completed, the turret-head holding the tools automatically recedes, while the revolving chucks rotate one-quarter turn and the turret-head carrying the tools again approaches and performs another operation on the ends of the four bars. The work proceeds thus, and between each operation the rotating chucks revolve one-quarter turn. When the bar arrives at the No. 4 position, the cut-off operation occurs, and the completed piece drops into the bed of the machine. In this way almost any shape of piece that is cylindrical in form can be manufactured. Six or even eight operations are accomplished by sliding cross-tools that automatically approach from a sliding cross position at the same time that an end operation is being performed.

In machining the upper member of the Drake lock-nut, the procedure is as follows: In the No. 1 position the stock is fed out and the centring-drill approaches and centres the end of the bar. At the same time a cross-slide forms the chamfer or top of the nut. The tools recede and the carriage revolves a quarter of a turn, placing the bar, which was formerly in No. 1 position, in

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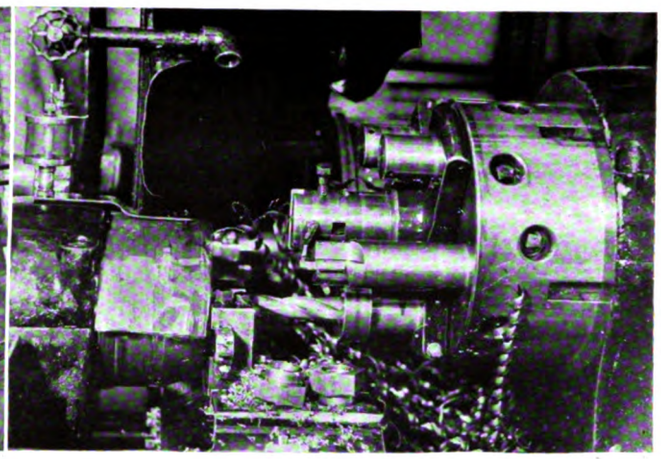
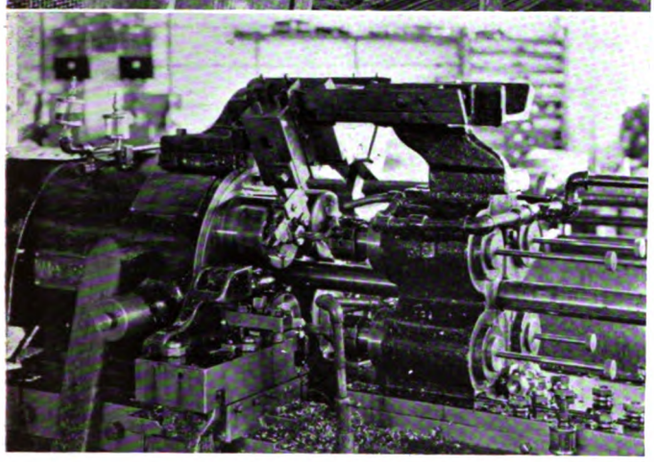




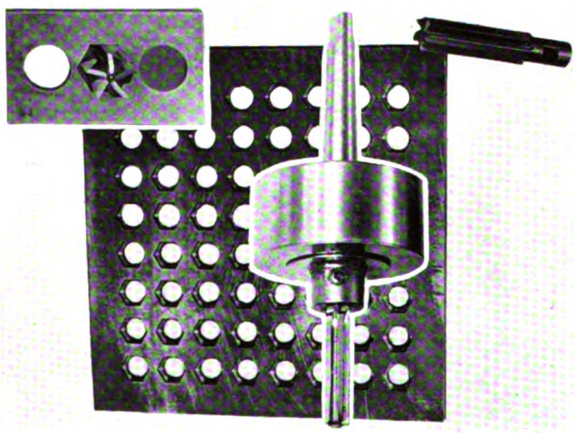
IN UPPER LEFT-HAND CORNER, GENERAL VIEW OF AUTOMATIC MACHINES AT DRAKE FACTORY. AT RIGHT, SINGLE SPINDLE CLEVELAND MACHINE. BELOW, FOUR-SPINDLE, ACME MACHINE.

No. 2 position. Then the tools in the turret automatically approach and the piece is drilled from the end, after which it revolves to No. 3 position and a counterboring tool approaches, and counterbores the piece. When operation No. 3 is finished, the piece is turned to the fourth position and is cut off by a cross-slide tool, which also approaches automatically, and the finished piece drops into the bed of the machine.

The lower member of the Drake lock-nut, which is the bottom of the whole nut when it is against the work, is made with the bottom-side out. In position No. 1 the piece is centred and a forming-tool from the flange approaches and breaks down the hexagon forming the cylindrical piece that is the top-part or lock-member of the nut. In position No. 2, the nut is drilled half-way through while at the same time a finishing tool on a cross-slide approaches and finishes the cuts on the cylindrical part, leaving it smooth and well-finished. In position No. 3 the piece is drilled through the second half and in position No. 4 it is cut off. The idea of drilling the piece half way through in position No. 2 and the second half in position No. 3 is to reduce the time of production, since the drilling operation is the longest operation and the entire piece would have to wait to complete the operation. When this operation is divided in half the production is correspondingly increased, for the carriage must stop at each position as it rotates.

An idea of the output of an automatic screw-machine can be obtained from the rate of production of either part of the Drake lock-nut, both of which are well-finished pieces of machine work. The pieces of quarter-inch nut sizes and five-sixteenths nut sizes are completely machined at the rate of 420 and 360 per hour and the half-inch nut, either piece, is completed at the rate of 240 per hour. Three-quarter inch and inch nuts, either piece, are finished at the rate of 130 and 100 per hour respectively. These figures are for the blank pieces, for, even though the threading and slotting operations could be done on the automatic machine, in order to save time the company has special automatic machinery that is much faster than the screw-machine for this particular purpose.

The advantages of automatic screw-machines are self-evident, particularly where labor costs are high. Without such equipment, many popular priced articles could not be marketed successfully, since frequently the labor-cost with screw-machines is as low as one-tenth of that where engine-lathes or even turret-lathes are used.



DRILL FOR BORING HEXAGONAL HOLES. ABOVE IS SHOWN THE GUIDE AND IN THE BACKGROUND A JIG-PLATE BORED WITH THE DRILL.

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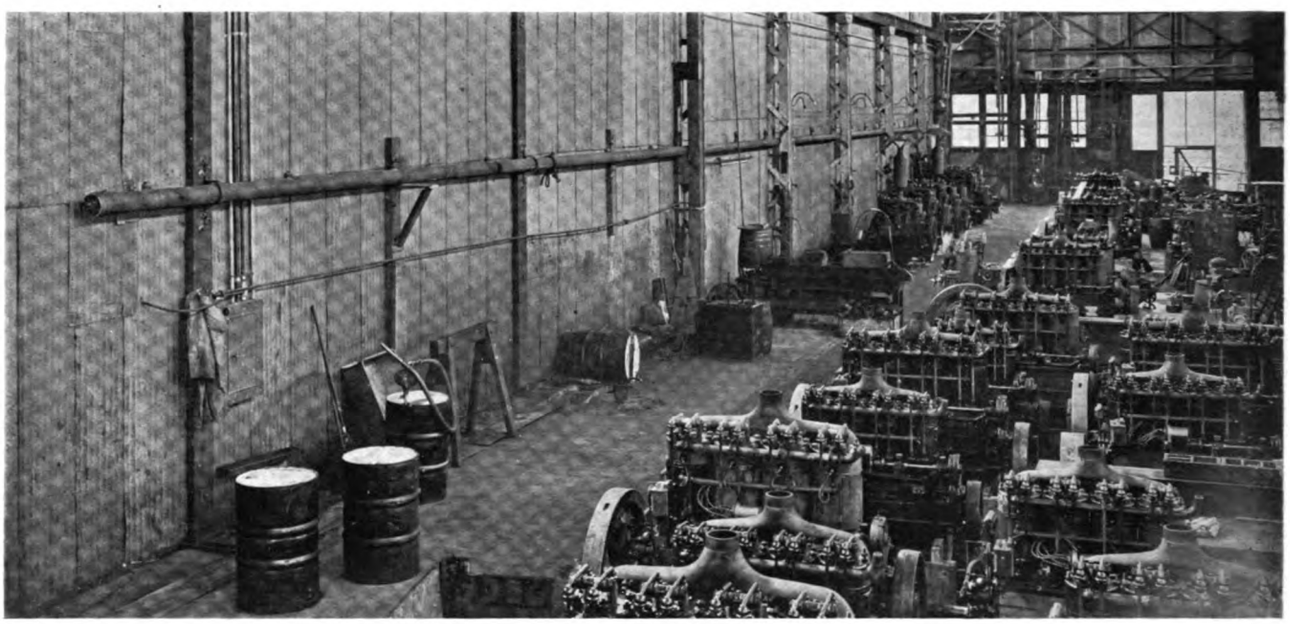

ENGINE-TESTING ROOM AT THE HOLT FACTORY AT STOCKTON

Captain R. W. A. Brewer, the Man Who Helped Build the 'Tanks'

An Interview
By A. T. PARSONS

So you have decided to stay in America, Captain Brewer?

Yes, I have been hoping to establish myself here since 1912 when I made my first visit to this country as the British representative of the Institution of Automobile Engineers at the annual convention of the American Society of Automobile Engineers, at Detroit.

How came you to be interested in American engineering developments?

In 1911 the American Automobile Engineers started what we all thought a wise move, in getting together with the members of the British Institution, and paid us a visit, primarily to look around the annual automobile exhibition in the fall of 1911, and also to visit the principal factories in England and France. The visit incidentally was the commencement of a close relationship between the automotive engineers in England and America, and we have subsequently visited each other on many occasions.

Did you become acquainted with our leading American automotive engineers at that time?

Yes, I had the pleasure of arranging many visits for them to the French factories, and accompanied them on their tour in France. The majority of the leading men in this field of engineering in America were members of the delegation, and I became close friends with them. This friendship I have maintained up to the present time. It was on this occasion that they invited me to come to America and pay them a return visit at the earliest opportunity, and this I decided to do the following year. After going over many of the factories in the East, I conceived the wish to locate in America as soon as I could make the necessary arrangements, and pending this, I came to an understanding with two firms in New York and Philadelphia to carry on my personal representation in the meantime.

I suppose it was the European war that finally brought you to this country.

Yes; a few days after the outbreak of war, I was asked by the head of the Mechanical Transport Department in England to be one of six engineers that he was authorized to engage to build up a department which had become necessary to carry out the enormous demands of the Army.

Had you any organization of this kind in the British army previous to this?

Yes, we had a very small organization comprising three or four officers and a few miscellaneous trucks.

What steps were taken by the British engineers to build up your transport service into the colossal dimensions which it so soon assumed?

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We started out on the system of impressment; a few officers were engaged to take off the streets any likely vehicles that could be used, and their value was determined and the money paid to the owner. These vehicles were formed into companies and driven down to the port of debarkation by any men that could be procured.

What part did you take in the early stages of this work?

In addition to inspecting impressed vehicles, it was necessary to obtain spare parts for them. This had to be most carefully done, because there were so many sizes and types of vehicles. Supplies also had to be obtained for these various columns as they left, and the officers had to be instructed in many details of this work. We also had to design and construct traveling workshops and stores, and obtain everything that the country could produce to maintain the vehicles that had gone to the fighting-front.

I think this was termed the Overseas department, was it not?

Yes, and in addition to the Overseas department there was the Home department, which had to handle the formation of new columns and their equipment. I first was head of the Overseas department and was subsequently transferred to the Home department, which I also organized.

How long had you worked in England after the outbreak of the War?

From the eleventh of August 1914 until the end of April 1915.

How did you come to be sent to America?

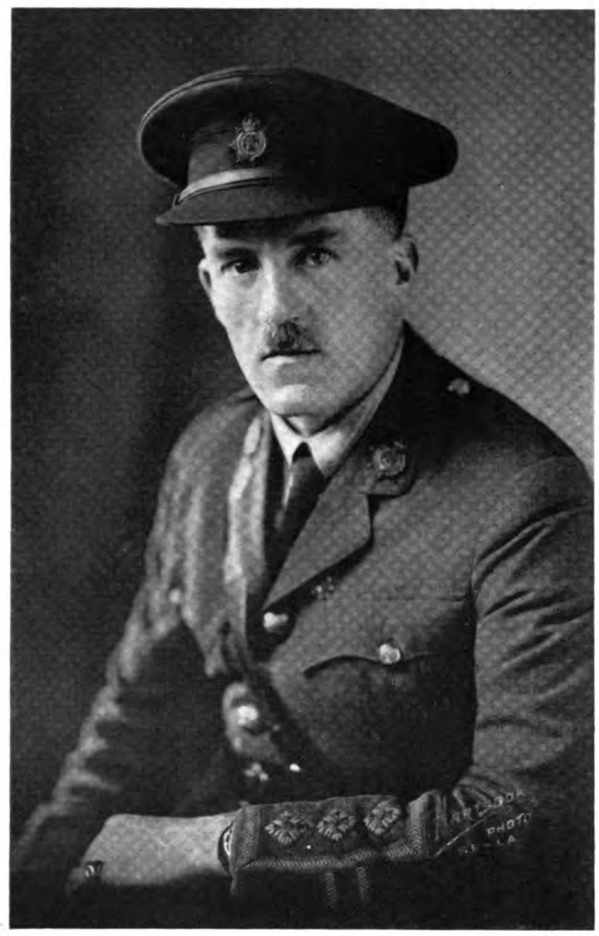
It was impossible to obtain the automobile trucks that were being demanded from overseas in sufficient quantity, and at the end of 1914 orders were being placed in America for tractors and trucks, and two officers were sent over here to take care of this work. On their arrival, they cabled to England for another officer to join them, and the War Office asked me to undertake this work on account of my acquaintance with American factories and the personnel of the firms here.

To what work were you assigned when you arrived?

I took over the inspection of 700 trucks at the Pierce Arrow factory at Buffalo and 200 trucks at the Packard factory at Detroit, as well as other miscellaneous work in the East.

Did you find any difficulties in co-operating with the American manufacturers in order to satisfy War Department requirements?

No; there was naturally some consternation on the part of the manufacturers as to the size of the orders for spare parts, as they could not realize the enormous wear and tear under war conditions, and it was necessary to impress upon them that these orders did not in any way reflect upon the quality of their product.



CAPTAIN R. W. A. BREWER

My greatest difficulty was to impress upon them that the quality of the work was of prime importance, and that instructions had to be carried out implicitly and without question; that there was a perfectly sound reason for every instruction given, and that there was to be no argument of any kind in regard to its carrying out.

What do you mean exactly by argument?

I have found that in many factories in America the employees have a desire to carry out certain work in a method of their own, in preference to the method laid down, and also that they do not realize the difference between a thing being right and being what they call 'commercial'. It is this question of 'commercial' quality that I have had to fight all along.

How have you come out in these arguments?

I have found that so soon as the employees realize that the inspecting officer understands thoroughly what is required and how it is best done, they have generally been willing to accept the ruling and carry it out cheerfully.

Can you tell me what is the feeling between the British inspection branch generally and American industry?

On both sides the feeling has been of considerable warmth and high regard. The American manufacturers have welcomed the British inspectors and the work that they have done in the factories in improving the quality of the product; the British inspection-staff, on the other hand, has been gratified by the co-operation of the

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ONE DAY'S INSPECTION WORK

American industries endeavoring to meet their requirements and, in many instances, making special efforts to meet urgent demands that have arisen.

When did you first go to the Holt factory at Peoria?

In September 1915 when we took on the inspection of this plant. At that time we did not even know that the most important parts of these machines were being made in California.

I suppose that is why you came to California?

Yes, that is why I came West in October 1915. We found that these machines were in a class by themselves for utility, and the British government had contracts with the Holt company until practically the end of the War.

Did you inspect many machines there?

About two thousand.

What part of the work was done at Stockton?

We built all the engines there, and the success of the machines depended more upon having these absolutely right than upon anything else.

I understand that an important gas installation was put in at the Stockton factory upon your recommendation.

ABOVE, INSPECTING TRUCK-ENGINE AND OTHER PARTS. BELOW, PUTTING TRUCK 'OVER THE BUMPS' ON INTENSIVE SERVICE TEST

Yes, this is the largest of its kind in California. It was principally with a view to avoiding a lot of work cleaning engines after test and making a more convenient method of testing that I recommended these gas installations.

How was this work carried out?

City gas is taken from the mains of the Western States Gas & Electric Co. The consumption of gas rose from 3000 cubic feet to 10,000,000 cubic feet per month after the installation, and this was at a

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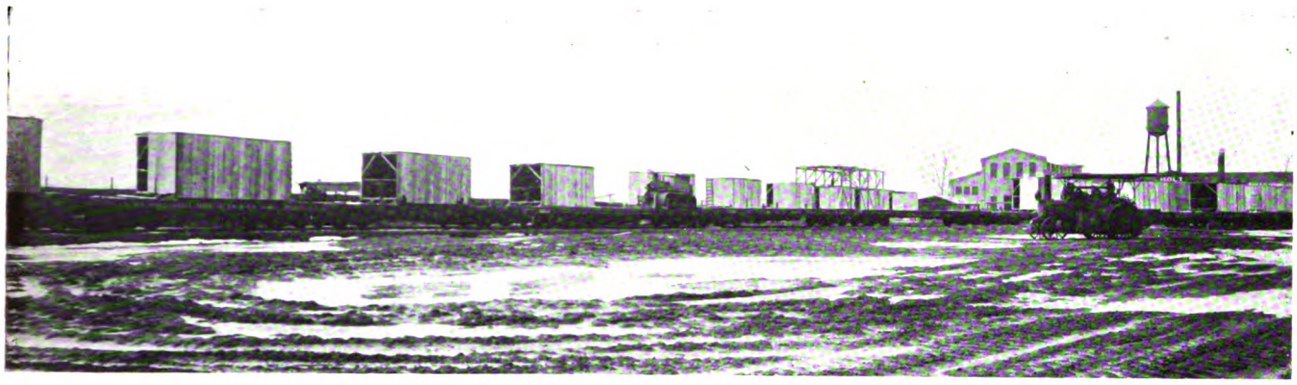
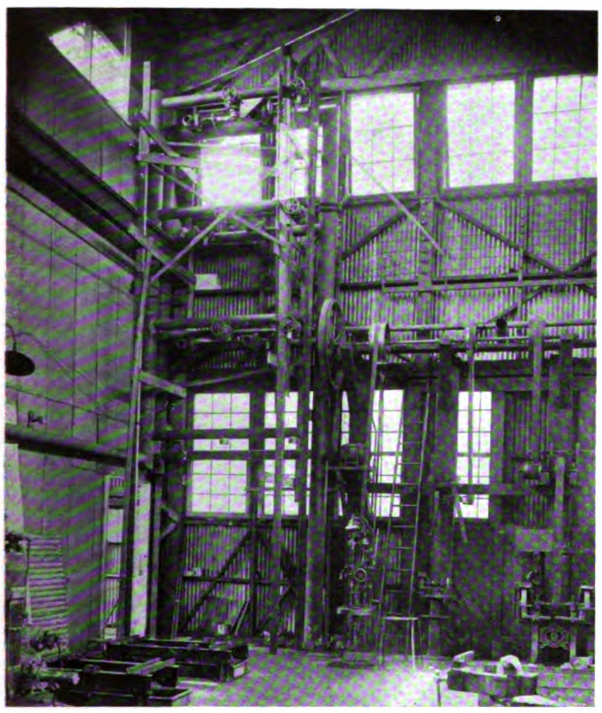


TRACTORS AT THE HOLT PLANT AT PEORIA READY FOR SHIPMENT OVERSEAS

considerable saving over the system previously employed, where distillate was used for fuel.

I suppose this installation was very interesting to Pacific Coast engineers.

Yes; I read a paper at the convention of the Pacific Coast Gas Association in Santa Cruz in 1917, dealing with the industrial use of gas, and honorary membership was conferred upon me.



GAS-MAINS AT THE STOCKTON PLANT. NOTE THE WELDED JOINTS WHICH WERE USED EXCLUSIVELY

Have you been doing other work in California recently?

Yes; I inspected and reported on a number of undertakings, and since June last I have been supervising a contract at the Moorhead Laboratories in San Francisco, for the delivery of a large number of vacuum valves, which are used in wireless telegraphy and wireless telephony. This contract was completed recently. I have now opened regular consulting offices here in San Francisco.

Going back to the beginning, Captain Brewer, how did you obtain your engineering training?

I come of a family of engineers. My father was engineer to the British government in Hongkong, and I was brought up in an engineering environment. At 15 I commenced an engineering course at Leeds University, studying both mechanical and electrical subjects, and subsequently, until I was 21, worked a regular apprenticeship in an English engineering works.

When did you first become acquainted with gas-engines?

I made my first gas and oil-engine tests as a student in 1893.

Did you follow up this work?

No, because the gas-engine industry was in its infancy, and I decided to be apprenticed in locomotive-building, which is one of the most highly-developed branches of mechanical engineering carried on in England.

Did you do any practical work in the electrical field?

Yes; after working several years in the locomotive factory of Kitson & Co., of Leeds, I was in the electrical works of Greenwood & Batley, of Leeds, for some time, engaged on the construction of electric-traction apparatus.

What did you do after that?

I went to sea as marine engineer for about two years, and obtained a certificate for this work from the British Board of Trade.

Did you go back into the gas-engine line?

Yes; after taking my certificate, I was appointed London engineer to the firm of Crossley Bros., Ltd., in 1900. They are, as you know, the largest and oldest makers of gas-engines in the world.

Did you join any engineering societies about this time?

Yes, I was then of the proper age to enter for my examinations for membership of the Institution of Civil Engineers, and while working for the above-mentioned

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firm, I was able to resume my technical studies, so that, in 1901, I passed my examinations for qualification.

Did you qualify for any other engineering societies?

Yes, I was also accepted by the Institution of Mechanical Engineers, and was a full member of that Institution till I resigned about two years ago.

When did you open your consulting offices?

This was a natural step, as there was not sufficient room for expansion in my existing work, and I opened offices, in 1902, on my own account in Westminster,

British War Mission
Inspection Department
in the
United States of America
1914 - 1918

In commemoration and appreciation of valuable services rendered in the United States of America to the Government of his Britannic Majesty, in connection with the provision of Munitions to the British Armies in the Field during the Great War, 4th August 1914 11th November 1918

This Certificate is given to
CAPTAIN R. W. A. FREYER,
Inspector, Mechanical Transport
April - 1915 - April - 1919.

Signed
Brigadier General
New York Director of Inspection of Munitions

London, which I maintained until the outbreak of the War.

How did you become associated with the automobile industry?

I have always endeavored to keep in touch with the latest developments in engineering work, and as the automobile industry was then in its infancy, I became interested in that field and was intimately connected with the investigation of fuel problems for the automobile bodies in England.

Have you done any engine-development work?

Yes; I have been engaged by some of the principal firms on the other side in developing automobiles and engines and have also been to various cities on the European Continent in connection with similar work.

I have seen your book on aviation in many of the libraries in America. I notice it is dated 1909, and that it was pronounced the leading book in English at the time.

Yes; I was one of the pioneers in aeroplane work and was active in that field for two or three yeors.

Tell me about the 'hot-spot' and the 'ram's-horn' manifold for gas-engines. I remember that the 'Journal' of the Society of Automotive Engineers in October 1917 called attention to that feature of the Liberty motor truck and termed it the most experimental thing about the engine.

There was really nothing experimental about it. I developed the 'hot-spot' and the 'ram's-horn' manifold in a car that I designed for one of the large companies in England in 1913. Previous to that time I had been acting as consulting engineer for the Sunbeam company, another prominent English automobile concern. I had been doing quite a lot of racing before that time, and when I was with the Sunbeam company we built several racing cars. A rival firm asked me to undertake a contract to improve their regular stock-car so as to enable them to compete with the Sunbeam car. I signed a contract to re-model their car, without radical changes, so as to attain a speed of at least 60 miles per hour. For every mile above 60 per hour, I was to receive a bonus. The car had been doing under 46 miles per hour.

That must have been a difficult undertaking.

The problem was to get a sufficiently high compression when the engine was running fast and at the same time to eliminate high compression at low engine-speeds with a full throttle-opening. As most automobilists have learned by experience, the ordinary high-compression engine is likely to give an objectionable knock, or even pre-ignition when picking up the speed of the car.

The manifold, which I patented, is so designed that at slow speeds there is no discharge of vapor or liquid from the mouth of the carbureter as is usually the case, but the pulsation is deflected from one branch of the manifold to the other in turn, and assists in charging the cylinders at alternate ends of the engine. The 'hot-spot' must be encountered by the carbureted air every time there is a change in direction of flow. At such times the liquid held in suspension is likely to be precipitated. In the latest form, the 'coning' of the pipes leading to the 'hot-spot' materially assists in breaking up the fuel and directing it to the heated surfaces.

What is the distinction between a 'hot-spot' arrangement and a heated air-supply?

The 'hot-spot' requires a temperature high enough to evaporate any particles of fuel, and this is much higher than can be attained by water. Further, only part of the fuel needs to be treated in this way, and the main body of the air should enter the engine as cool as possible to give the maximum power. A heated air-supply, on the other hand, is not kept at a sufficiently high temperature to vaporize all the fuel, and most of the air is, at the same

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time, heated unduly, causing a drop in the power-supply.

Were you successful in designing a car according to the requirements of your contract?

Entirely so. Stripped for racing, it developed a speed of 75 miles per hour, and I had the pleasure of driving the car in its first race, which I won, at the Brooklands Easter meet in 1914.

The manufacture of internal-combustion engines is engaging the attention of many of our local men in the metal trades. Have you studied the situation in this district?

Yes; one of the principal reasons for opening my offices here in preference to some other city was my conviction that this district affords an excellent opportunity for the development of internal-combustion engine manufacture, particularly for marine work.

How, in your opinion, does the Diesel engine compare with the steam-engine for marine propulsion?

Briefly, I consider that not only is the use of Diesel engines on the Pacific Coast vital to the future prosperity of local ship-owners in competition with other means of transportation, but it is also true that the San Francisco Bay district is the ideal headquarters for fleets of ships thus equipped. Every consideration favors the use of local fuel, and I think that the internal-combustion engine is the proper means for so doing.

Oxy-Acetylene and Electric Welding on Dredges

*The Canadian Klondyke Mining Co. operates three (the fourth is out of commission) large dredges near Dawson in the Klondike, and in its machine-shop has a good deal of repair work to undertake. A complete plant for the generation of oxygen and acetylene gas from chemicals was installed and in operation since last fall, together with a complete line of oxy-acetylene welding equipment and tools, including compressors for the purpose of storing gases under pressure in low-pressure cylinders constructed for that purpose. A valuable addition to this plant, and one which will largely decrease the cost of manufacturing oxygen gas, is now being completed by the installation of 10 Vulcan electrolytic cells for the manufacture of this gas from water by electric current. The present cost of oxygen gas approximates 15 cents per cubic foot. On completion of the new machinery this cost will be reduced to less than 1 cent. A valuable by-product from this process will be hydrogen gas, which can be stored at no additional expense, and which will be extremely valuable in connection with many uses in the welding and machine-shop. The installation, as an adjunct to this department, of an electric-arc welding-plant, consisting of a suitable direct-current generator, with a complete line of electric-arc welding-supplies, has also been made; and has been in operation for a number of months whenever the necessary power was available. In addition to repair work during the operating season, the above-mentioned equipment places the company in a position to operate throughout the entire winter with both electric-arc and oxy-acetylene torches on dredge-bucket reclamation work, and on all repairs where the welding and putting-on tools can be utilized to advantage. The total cost of this installation to date, including accessories, amounts to the sum of $12,757.

It is not too much to say that the value of the repairs and reclamation work accomplished by the welding department to date, if credited to that department, would already offset the major portion of the investment. With this equipment it will be possible to reclaim and place again in service over 120 dredge-buckets that have been cast aside as unfit for further service at an expense which will approximate less than $150 per bucket. As the landed cost of these buckets at the present time is almost $1500 each, the resultant possible saving can be appreciated more readily.

A campaign of dredge-bucket reclamation has been arranged for the winter months, in connection with which a course of investigation is being conducted by the receiver as to the practicability of erecting a one-ton unit electric furnace for the melting and re-manufacture of scrap steel into bucket-lips, bushings, etc. In view of the excessively high cost, unsatisfactory delivery, and heavy investment charges that the present market presents to the management in the matter of steel dredging repair-parts, such an installation is being taken under the most serious consideration. To give a small idea of the convenience and saving possible to be effected by the welding-plant installations, the following may prove of interest:

On June 6 last it was necessary to close down the Hunker pumping-station owing to a bad crack in the main controlling-valve. This part could not be replaced here, and to bring one in from the manufacturers would have meant the loss of many weeks and consequent decrease in production of many thousands of dollars. The repair was made by the company's oxy-acetylene welder at a total cost of $237, and the pump started, with total lost time of 34 hours and 4 minutes.

The de-plating and building-up of the faces of a lower tumbler of a dredge will serve as an illustration of the saving effected by this process:

	Former method	Welding
Cutting out countersunk rivets (labor)	$56	$14
Material for shims	180	80
Labor	155	50

The cost by the welding method would be reduced still further by using scrap steel for the building up material, although it is doubtful if the result would be as good.

*Abstracted from report of the receiver, and manager, H. G. Blankman, for the Canadian Klondyke Mining Co. for 1918.

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A Motor-Propelled Vehicle for Snow Conditions

AN interesting development of coast metal trade activities is the formation of the Standard Snow-Motor Corporation of Seattle to manufacture a motor-propelled vehicle for use on snow-covered roads. Since the advent of motor-propelled vehicles, inventors have been endeavoring to adapt it to winter use, but the characteristics of automobile wheels, particularly their habit of plowing into snow instead of gliding over it, have hitherto prevented success. The chief obstacle has been road conditions. Even on a well-packed road the automobile will skid and lose traction, while on an unbroken road it would plow in and bury itself.

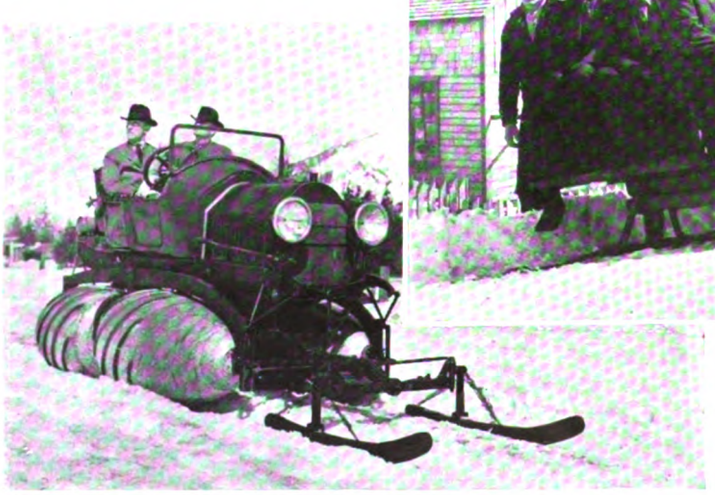
The machine shown in the accompanying illustration provides a satisfactory means of achieving snow transportation. The drums, which replace wheels, are so constructed as to give a constant upward tendency to the car and to pack sufficient road for the spirals to secure traction. The machine has a standard, four-cylinder, heavy-duty motor, equipped with the ordinary automobile accessories for ignition, lighting, starting, etc., mounted on the ordinary chassis to which are attached the drums. In addition to the ordinary transmission, an intermediate shaft extends to the patented differential. This is a case containing three meshed gears, transmitting the power to trunnion-shaft and sprocket-wheels, which, in turn, transmit the power to the main driving gears between drums on either side. The general method of operation is the same as for an ordinary motor car. The drums, which are 30-in. diam., revolve in opposite directions. They are of pressed steel and are suspended on the strut so as to permit them to oscillate through a space of 12 in. This fact, together with the smoothness and taper of the front drum, which packs 12 in. of snow before reaching the spirals, makes it possible for the car always to stay on the surface, even when approaching heavy drifts or steep grades of soft snow on an unbroken road. The runners, which carry only one-tenth of the load, are for steering only.

Careful tests under all kinds of weather and snow conditions show that these machines are capable of doing the same work in winter that an automobile or a motor truck can do in summer. The gasoline consumption per mile for the roadster-type machine is slightly larger than that of a three-ton truck. On the other hand, there is, of course, no tire expense and the wear on the drums is nominal, even when it is necessary to operate the machine over short stretches of road with no snow on it.

The Snow Motor Company is building a factory at Seattle for the assembling of the machines. Headquarters for California, Nevada, and Oregon have been established in the Bankers Investment Bdg., San Francisco, with M. A. Tucker in charge. An interesting motion-picture reel has been prepared showing the snow motor in actual operation.

"WAITER," frowned the diner, "there's a fly in this ice cream."

"Serves him right, sir," replied the waiter. "Let him stay there and freeze to death. He was in the soup yesterday."—'The Yellow Strand'.



AT LEFT, ROAD TYPE OF MACHINE. AT RIGHT, SAME MACHINE HAULING TRAILER WITH 7300-LB. LOAD AT EASTON, WASHINGTON.

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Electric Furnaces for Heat-Treating and Shrinkage

By A. M. CLARK*

A NEW type of electrical resistance-furnace for heat-treating and shrinking has recently been developed by the General Electric Company. Two types of furnaces are made, a high-temperature furnace with a range up to 1800°F. used for tempering, annealing, and hardening, and a low-temperature furnace with a range up to 950°F. used for such work as shrinking collars on crank-shafts and rims on wheels.

These furnaces are constructed in sections and have been built as much as 88 ft. long. The best example is at the Washington Navy Yard, where guns of large calibre were built during the War. This furnace is of the vertical cylindrical type sunk into the ground to the required depth. A section is shown in Fig. 2. The internal construction is shown in Fig. 1.

FIG. 1. INTERIOR OF ELECTRICALLY-HEATED FURNACE

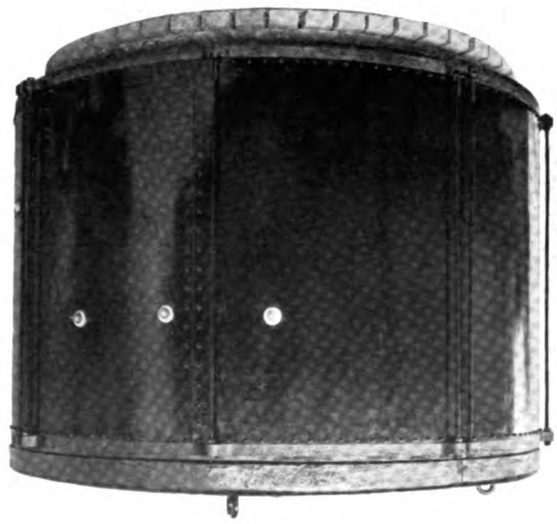

FIG. 2. OUTSIDE VIEW OF SAME FURNACE

Furnaces consisting of more than one section are usually equipped with a hand-control, which permits bringing the charge up to temperature at a uniform rate throughout the length of the furnace. When a one-section furnace is used, it is ordinarily provided with automatic control.

A complete one-section furnace consists of a cylindrical section, cover, base, and work-base. The cylindrical section consists of top and bottom castings with supports, inner and outer casings enclosing the insulating material, and heating units and guards. The cast rings that form the ends of the section are recessed in such a manner that the sections can be stacked one above the other, which permits constructing a furnace of any desired height from standard sections. Provision is made for the unequal expansion of the inner and outer casings because of difference in temperature. The amount of metal extending through from the inner casing to the outer casing has been kept as small as possible, hence the heat losses are reduced to a minimum.

The heating unit consists of a calorite ribbon mounted on a cast-iron supporting-plate, and insulated therefrom by suitable refractory material. A number of units are connected in series depending upon the voltage of the power supply. All connections are made with flat-steel bus-bars, as experience has demonstrated that the best connections can be made between flat surfaces, and steel will not oxidize at the temperatures employed in these furnaces.

The construction of the vertical-cylindrical high-temperature heat-treating furnaces requires the use of a heavy calorite ribbon supported on the inner walls of the furnace.

The furnace is divided into a number of separate heating-zones with an automatic temperature-control for each. As indicated in Fig. 3, the walls consist of an inner lining of refractory brick and insulators backed by a

*Industrial Heating Department, General Electric Company.

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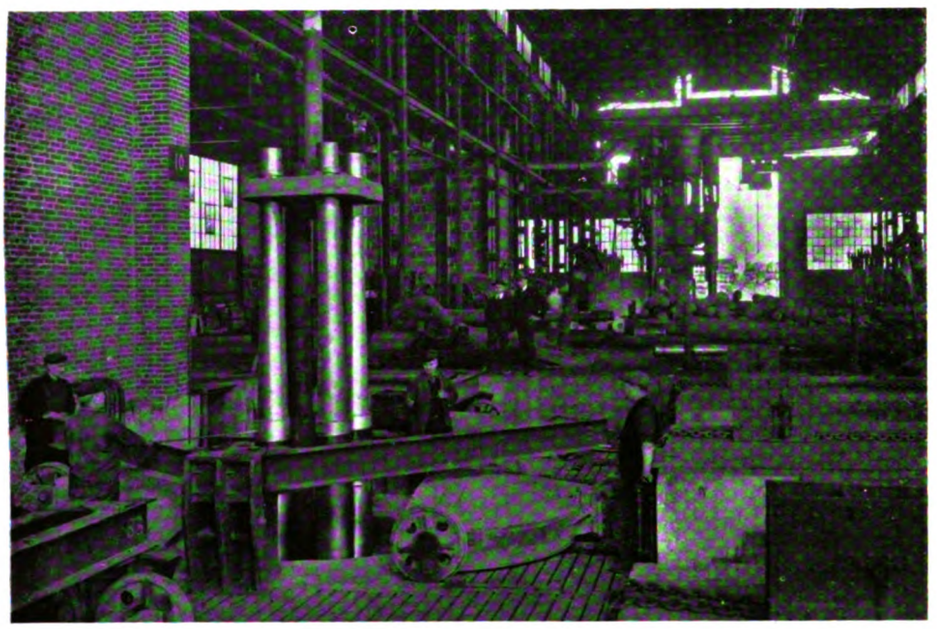
double course of insulating brick and protected by a sheet-metal casing. The ribbon supports and insulators are both of a molded special compound laid in the lining of refractory brick with a spacing-block of the same material placed between the insulators of adjacent windings, or zones. The insulators, spacers, and spacing-blocks are



CHARGING ELECTRIC HEAT-TREATING FURNACE, INSIDE DIMENSIONS 22 FT. DEEP AND 6 FT. DIAMETER

fitted at the back into a steel channel, *H*, which is a ring made of a number of sectors tied together by bolted clamps, the latter not being shown in this figure. The

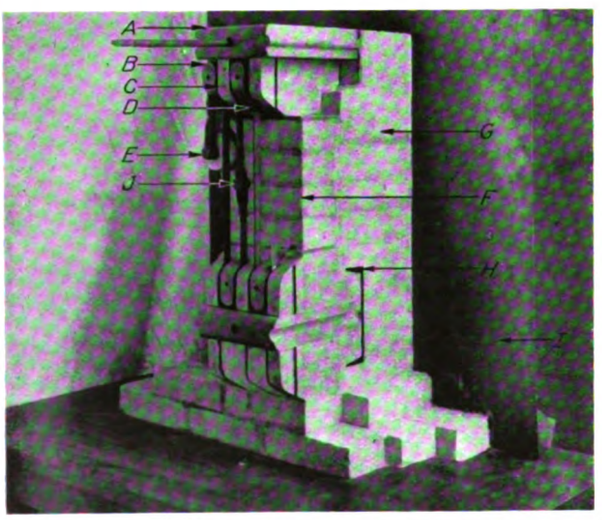


FIG. 3. SECTIONAL VIEW OF HEAT-TREATING FURNACE, SHOWING CONSTRUCTION OF WALLS, ALSO REFRACTORIES CONVEYING HEATING-RIBBONS.

spacing-block *A* acts as a protecting buffer for the ribbon-support insulators and any blow is transmitted to and distributed by the channel. An opening is provided in the spacing-block for the charge-pyrometer tube, with a similar opening for the ribbon-pyrometer in the support-insulator at *D*. The ribbon is welded to the terminal stud, *E*, and adjacent lengths of ribbon are welded to the splice-piece, *J*. It will be noted that the ribbon-insulators are protected from mechanical injury by the spacing-blocks and the shape of the former is such that any scale or dirt cannot accumulate and cause short-circuiting of the ribbon-winding, but will fall to the bottom of the furnace. The ribbon-insulators, being imbedded and forming a part of the furnace-wall, hold the ribbon firmly in place and eliminate the need of any form of metallic support, with the inherent weakness of the latter at high temperatures. Furthermore, the omission of all metal, except through ribbon windings, insures quick heating of the furnace and reduces to a minimum the waste of energy due to heat storage. Each section is provided with a control-panel, and is controlled independently of the other sections. The control instruments may be set to hold any desired temperature. There are two thermo-couples in each furnace section, one of which is placed near the resister, and the other against the charge.

There are a number of heat-treating processes in the manufacturing industries requiring temperatures from 900 to 1800°F. Chief among these may be mentioned drawing and annealing carbon steels, drawing high speed steels, annealing brass and copper, and baking vitreous enamels. The advantages of electrically-heated furnaces constructed and equipped with heating units and temperature-control systems as described are automatic control of the temperature, minimum temperature variation in the furnace, maximum rate of heating the charge, uniform heating throughout the charge, maximum efficiency in heat-treating, elimination of scale caused by oxidation, uniform results day after day, and elimination of combustion methods with their attendant fuel troubles and uncertainty of results.

ABRAHAM GOLDSTEIN was a tailor. His sign was an apple, simply an apple.

People were amazed at it. They came in crowds from far and near, and many made inquiries regarding its meaning.

"Vy," said Goldstein, "if it hadn't a' been for an apple, vere in the world vould the clothing pizness be today?"

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Fire Prevention in the Metal Trades—Part II

By R. E. SWEARINGEN

THIS is the second of Mr. Swearingen's articles, the first appearing in the May issue. The present article deals with methods of construction as applied to fire-prevention. Mr. Swearingen is engineer for the Fire Prevention Bureau of the Pacific.

IN no class of industry is good construction more important from a 'safety-from-fire' standpoint than in metal-working plants. The fact that the stock handled is largely incombustible makes the problem of safe construction easier to solve than in many other classes of occupancy where the goods handled are of a combustible nature. This should not lead to the belief that any sort of construction is safe enough for the metal industries, although this belief seems to be prevalent on the Pacific cost, the construction of our metal-working shops being generally poor.

If either complete fire-prevention or absolute fire-control through fire-protection were possible, building construction as a factor in our fire losses could be disregarded. Neither is possible, however, and we must erect our buildings so as best to resist the spread of fire.

Fires spread in three general ways: first, from floor to floor in the same building; second, from one building to another adjoining; third, from one building to another one detached. They spread from floor to floor chiefly through unprotected floor-openings and by burning through the floors themselves, while they spread from one building to adjoining ones mainly through burning combustible walls, and unprotected wall-openings. They spread from one building to others not adjoining through combustible roofs, combustible exterior-walls and additions, and unprotected wall-openings. The problem of building construction is to design and erect, at a reasonable cost, structures that will offer maximum resistance in any of the foregoing ways and at the same time be best adapted to the use for which they are intended. It takes money to incorporate fire-protection features in erecting a plant, but it is money well-spent.

Considering the means by which a fire spreads, it is clear that the most desirable form of construction is one that will resist the greatest degree of heat throughout, including floors, walls, floor-openings, and wall-openings.

Building construction may be divided into five main classes as follows:

1. Fire-proof, or as it is now better known, fire-resistive.
2. Mill or slow-burning construction.
3. Ordinary brick or concrete.
4. Metal-clad.
5. Frame.

Fire-resistive construction requires the use of masonry, or steel and masonry throughout, with all steel work protected by concrete or terra cotta. Mill-constructed buildings are those with brick or concrete walls and heavy tight-plank floors supported by heavy wood timbers and columns. Ordinary brick or concrete construction is that having brick or concrete walls, and joisted wooden floors. Frame buildings are those built entirely of wood. Metal-clad buildings are similar to frame buildings, but with metal-covered walls, generally corrugated iron nailed direct to the wood wall-framing without sheathing.

Fire-resistive construction is the best type of building for any class of occupancy and should be employed where practical. However, this type of construction is more expensive, and there are sometimes operating advantages in buildings with wooden floors. For some metal-working plants, such as foundries and forge-shops, any non-combustible construction is just as good as standard fire-resistive construction, although this is not true in plants housing combustible material. A serviceable foundry can be erected of steel frame, corrugated iron, brick or concrete walls, steel truss roof with iron, reinforced concrete or tile covering.

Generally speaking, mill-constructed buildings are the most serviceable for the majority of industries, including metal-working plants, and, if adequately protected against fire, are practically as safe as fire-resistive buildings. In such buildings, all stairways and elevators should be in brick shafts to prevent the spread of fire from floor to floor. From a fire-prevention standpoint it is best to limit the height of industrial buildings, irrespective of the type of construction, to three or four stories.

Joisted-brick buildings of moderate area and height are often nearly as good as those of superior construction, particularly when the occupancy hazard is light and when they are equipped with sprinklers. Frame and metal-clad buildings are the cheapest and easiest to construct, and therefore often necessary, but this type of construction is not to be recommended for permanent plants, for no matter how incombustible the contents may be, the buildings will always be subject to swift destruction.

The necessity for protecting a plant against an outside fire is often overlooked, especially in our congested

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cities, where it is impossible to isolate plants from neighboring buildings. When, through unprotected window and other wall openings a shop is seriously exposed by another, the fire hazards of both plants may be said to exist in each. To eliminate this danger from outside plants, wall-openings should be protected by approved metal-frame wire-glass windows or tin-clad shutters.

No one type of construction is applicable to such a large class as our metal industries, but a few general rules may be given for designing new plants:

1. Use the best type of construction practicable.
2. Protect vertical openings, irrespective of construction.
3. Limit areas where contents are combustible to as small units as possible, and always cut off hazardous departments such as varnishing and japanning rooms and oil-storage rooms from the remainder of the plants.
4. Protect exposed wall-openings.

In old plants much can be done structurally to reduce the fire hazard, chief of which are: properly protecting all vertical openings, elimination of concealed hollow spaces formed by sheathing on walls and ceilings; reduction of combustible finish to a minimum by removal of wooden partitions, shelves, etc.; removal of wooden cornices, overhanging wooden roofs, adjoining frame sheds, unnecessary wooden roof-structures, wooden bridges, etc.; replacing plain-glass skylights by wire-glass in metal frames, except over stair or elevator shafts, where thin glass should be used; replacing shingle roofs by incombustible roof coverings; interior whitewashing; and protecting exposed unprotected wall openings.

The number of fires can be greatly reduced, but they cannot be entirely eliminated, and adequate means for extinguishing any fire that might start is necessary in all plants. Just what protective equipment is necessary depends on the construction and occupancy of each property, for what would be adequate protection in one plant might be totally inadequate in another.

The most important form of fire-protection is the automatic sprinkler. The record of this device in all classes of industry is remarkable. A sprinkler equipment consists of a system of iron piping suspended from the ceiling; the sprinklers themselves, or 'heads', being placed on the pipe at regular intervals so that the space between them is 8 to 10 ft.; the whole system is under direct pressure of at least one automatic water supply. The sprinkler-head is really a nozzle with the orifice normally kept closed by solder. This solder melts at 160°F. When a fire occurs, the heat, rising to the ceiling causes the sprinkler or sprinklers directly over the fire to open. If the fire spreads, additional sprinklers open, but experience shows that less than five usually extinguish the fire, or at least hold it in check until the arrival of the fire department.

When installing automatic-sprinkler systems the following fundamental principles should be observed:

1. All parts of the plant should be equipped, except special buildings such as a fire-proof or incombustible foundry or forge-shop.
2. An adequate supply of water should be provided, preferably two supplies independent of each other.
3. There should be freedom from concealed spaces and obstructions to distribution.
4. There should be a standard system of piping.
5. There should be systematic and intelligent supervision and maintenance of the system so that it may be in service at all times. It must be admitted that sprinklers are not practical in very small plants, because of their first cost, but they will usually be found to be a good financial investment when the values reach $100,000.

All plants, whether sprinklered or not, should have other protective equipment, but in unsprinklered ones the need is greater and more apparatus is necessary. The ordinary fire-extinguishing apparatus is intended primarily to take care of incipient fires. The best combination of fire-equipment for inside use consists of 1½-in. hose, water-casks and pails, and chemical extinguishers, the amount or proportion of each depending on the construction and occupany of the plant. Where benzine, paints, oils, etc., are stored or used, a liberal supply of pails with clean sand should be provided. For electric and automobile fires, one-quart carbon-tetrachloride extinguishers are of value, but water is useless.

Private outside fire-fighting apparatus is often desirable, and for large plants without public protection, it is absolutely necessary. Adequately to protect an isolated shop, ample hydrants, hose, water supplies, and minor equipment must be provided, together with a well-trained fire-brigade under capable supervision. The underground distributing mains should be a circulating system of at least 6-in. pipe; usually 8-in. pipe is desirable, and should be gridironed in the case of large installations. Hydrants should be placed not closer than 50 ft. from the buildings to be protected, and should be spaced so that at least two streams are available at all important points. Hose-houses should be placed over most hydrants and each should be equipped with from 100 to 250 ft. of 2½-in. cotton rubber-lined hose, 2 play-pipes, several spanners, washers, lanterns, axes, and minor equipment. It is often desirable to have part of the hose placed on a cart or carts where it is easily accessible.

The water supplies necessary depend on the nature, size, and construction of the plant. Steam or electric fire-pumps are often the only sources available. Steam-pumps require a constant and ample supply at all times, and electric pumps a reliable source of electricity. Additional supplies often available are public water-works systems and gravity tanks or reservoirs.

A well-organized and drilled fire-brigade is necessary if efficient use is to be made of private waterworks systems and fire-fighting apparatus. It should be remembered that it is of just as much importance to have the brigade available at night and on Sundays and holidays as during regular working-hours. Watchman's service should be maintained at all times when the plant is not in operation. A complete round of the important buildings should be made at least once an hour, and rounds

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recorded on a regular watchman's clock or central-station system. The watchman should be sound physically, of good character and intelligence, and should be thoroughly acquainted with the position and use of all fire-protection appliances.

In the event of a fire the first duty of the watchman or other person that discovers it, is to ring the fire-alarm. In large plants an approved private fire-alarm system with boxes at various points is necessary, in order to get the department into action in the quickest time. A few minutes at the start of a fire may be worth more than hours later. The situation of the nearest public fire-alarm box and the method of turning in a fire-alarm should be known by all employees.

No feature of fire-prevention and fire-protection is more important than systematic and frequent inspection of the plant by one or more employees trained to do this sort of work. This is true whether it be a small shop with two or three hands or an establishment employing 10,000 or more. In the first case the head of the shop can and should devote a few minutes per week to this work, while in the other a regular plant fire-marshal with one or more assistants may be kept busy at all times, doing nothing else but watching the fire hazards and looking after the fire-fighting equipment. Fire-fighting apparatus, fire-doors, fire-alarm systems, etc., are worse than useless if not properly maintained, for they develop a false sense of security. Very large plants should have their fire-prevention work supervised by a regular fire-marshal, preferable an ex-officer of a city fire department. Such a man should have entire charge of the organization and drill of the private fire-brigade. Without doubt, the work of the shipyard fire-marshals is what kept the fire losses in our Pacific coast yards to such a low figure during the last eighteen months.

The average plant is too small to warrant the expense of a regular fire-marshal, but it is not too small to use part of the time of a competent man or two for this service. Regular inspections should be made, preferably weekly, and written reports submitted to the superintendent, or the chief executive. The inspector should see that oily waste is properly cared for, that the 'No-smoking' rule is not violated, and that the cleaning force is giving proper attention to all parts of the plant. He should examine all fire-barrels and pails to see that they are full, fire-extinguishers to see that they are in place and in good condition. The latter must be discharged, cleaned, and re-charged at least once a year. Hose must be examined to see that it is in good condition and nozzles properly attached. Fire-doors and shutters should be tested weekly and kept in good condition at all times. Automatic-sprinkler systems require special care, for all tanks must be kept full, shut-off valves strapped open, alarms in condition, and fire pumps in order at all times. Outside hose-houses, hydrants, etc., must also be regularly examined.

After making the inspection a written report should be made on a blank prepared to suit the special needs of the plant. The blank should cover all the essential features but need not be burdened with too much detail. Steps to have all defects corrected should be taken at once. The chief executive should interest himself in the fire protection of his plant and should make an occasional inspection from that standpoint.

The problem of ample fire prevention and fire protection in the metal trades can be solved when the buildings are built to stand rather than to burn, when adequate fire protective equipment is provided and properly maintained, and when every person connected with the industry does his share in eliminating unnecessary fire hazards.

New Method of Paying Wages

An important firm of British soap-makers, Lever Bros. (Ltd.), is preparing to introduce a new method of paying wages, which the chairman of the company outlined thus at the recent annual meeting of shareholders:

"As to payment of wages, we want to introduce a different method. Instead of our men crowding round the wage-office and waiting their turn, each man should have a little private banking account in a bank near his own house—not the firm's bank, but one of his own selection. We would advise our bank to credit each man from the pay-sheet with the amount of money he is entitled to receive for his wages. Under this system a man will draw out of his bank what he wants for his household expenses and what he does not need will rest in the bank. The amount left as deposit with the bank will be supplemented by an addition from the firm—we are favorably considering this—and this will give a man 5% on his money left in the bank; so that, instead of the money lying at home earning no interest, by adopting this system it will earn interest. Further than that, the tendency will be always to leave a little more each week in the bank, and I feel confident that if we can get this system universally adopted it will not only raise the workingman's position but add to his dignity, because, instead of crowding round a little pay-office, he will be led to become a saver, having money to invest in the business he is engaged in, or other businesses."

BLONDINE: Did you have a good time at the dance last night?

Brunetta: Kinda.

"Who was that handsome chap I saw you with just after the intermission?"

"He is a stranger in town."

"Dashing, isn't he?"

"Nerviest gink I ever seen."

"I noticed he had his arm rather tightly about you."

"Do you know why he had me clutched that way?"

"No."

"Well, would you believe it, he had me that way so I couldn't escape, and all the time we were dancing he was trying to sell me some life insurance."

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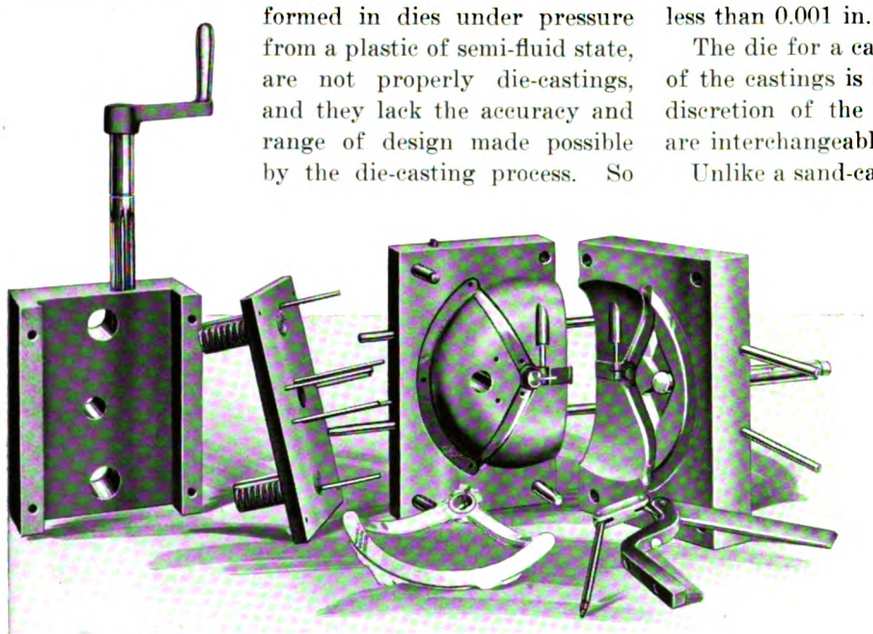
Die-Casting*

DIE-CASTING machines for making type, which were the forerunners of the modern machines, were built in this country over seventy years ago. The modern industry is about thirty years old. Like the other metal industries, die-casting received great impetus during the War, millions of parts for motors, bombs, shells, grenades, trench-mortars, and guns being die-castings.

To be a die-casting, the part must be cast from fluid metal forced under pressure other than gravity into a metallic mold, sufficiently below the temperature of the fluid metal to chill it. Parts poured in non-metallic molds, or poured in metallic dies by gravity only, or formed in dies under pressure from a plastic of semi-fluid state, are not properly die-castings, and they lack the accuracy and range of design made possible by the die-casting process. So far, the only metals cast successfully on a commercial scale are the alloys of zinc, tin, lead, and aluminum fusing below 1300°F. The production of brass and bronze die-castings, except a few very simple forms, has not thus far been a commercial success. When the particular strength and qualities of steels and bronzes are required, die-castings cannot be substituted for parts made of these metals.



PARTS OF DIE FOR SECTOR OF ALUMINUM STEERING-COLUMN. AT THE LEFT IS THE CAST-IRON DIE-BOX WITH THE PINION OPERATING THE EJECTOR-PIN PLATE SHOWN NEXT TO IT.

Exact data regarding the accuracy to which die-castings may be held cannot be given, as it varies with each part. The following table gives the approximate variation plus or minus in inches.

	Dimensions				
	Under 1 in.	1 to 2 in.	2 to 4 in.	4 to 8 in.	Over 8 in.
Lead and tin alloys..	0.0010	0.0015	0.002	0.0030	0.0035
Zinc alloys	0.0015	0.0020	0.003	0.0035	0.0040
Aluminum alloys ..	0.0020	0.0030	0.004	0.0050	0.0060

Dimensions across the parting line of dies are hard to hold to close limits because it is almost impossible to keep the die-surfaces absolutely clean. The pressure used in casting also has a tendency to force the dies apart. This is particularly troublesome with large castings under high pressures. Some inaccuracy may also occur in the parts of castings that are formed by slides or moving parts in the dies, as dirt or else particles of metal sometimes prevent the slides or cores from going completely home. Holes in which a close fit, that is, a variation of less than 0.001 in., is needed should be reamed.

The die for a casting is virtually a gauge, and the size of the castings is in no way dependent upon the will or discretion of the operator. Consequently, die-castings are interchangeable.

Unlike a sand-casting, a die-casting has a perfect finish over its entire surface. The die-casting process allows a wide range of design, and die-castings are used in the manufacture of many devices that could not be produced commercially by any other method. In general the practical limit of size for a single casting is 10 lb. in zinc and tin alloys, 15 lb. in lead alloys, and 3 lb. in aluminum alloys. The size seldom exceeds 24 in. over all. Walls $\frac{1}{16}$ in. and sometimes $\frac{1}{32}$ in. thick may be cast, depending on the size and design of the parts and on the metals used.

One advantage of the die-casting process is the reduction of assembling. Frequently two or more parts that must be produced separately and assembled by other processes may be combined in a single die-casting. The result is greater accuracy, lower cost, better appearance, and usually greater rigidity and strength. When assembling cannot be avoided for individual pieces, the parts may be so designed that the work of assembling is much simplified.

Die-castings cannot, as a rule, be made faster than plain punchings or simple screw-machine parts, but they can be produced much faster than similar parts can be sand-cast and machined. On long runs an average of over 300 operations per hour has been attained. The die-casting process is usually more expensive than sand-casting. For that reason, sand-castings that may be used without machining or finishing operations cannot be die-cast to advantage. When machine work is done,

*Abstract from 'Handbook of Die-Castings' by Edgar N. Dollin, published by Precision Castings Co., Syracuse, New York.

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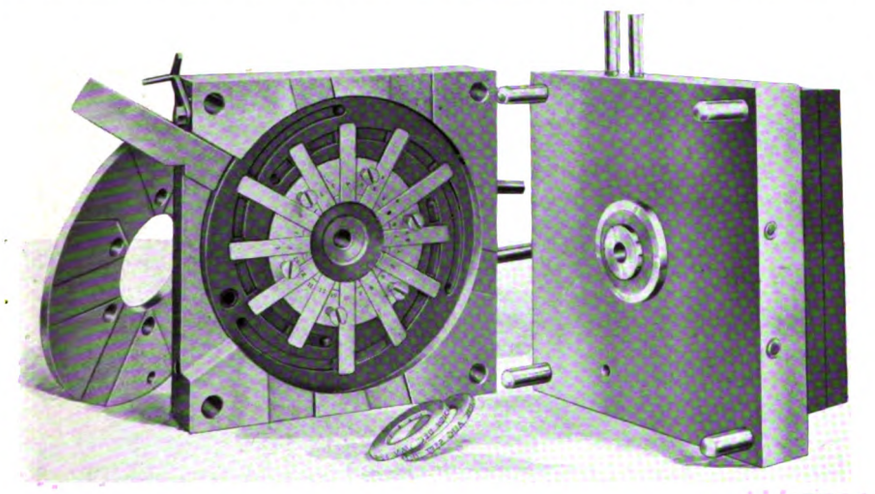
it is simpler and cheaper than the same work on sand-castings, since the die-castings are more uniform, and since they can be set in jigs and fixtures with greater ease.

Setting dies and getting them started is slow and troublesome work. New dies require some time to be 'broken in'. For these reasons, the process is suitable to quantity production only. Generally speaking, one thousand pieces is the minimum for economical production, but heavy and expensive parts are sometimes made to advantage in smaller quantities. The white metals used for die-casting are all more expensive than iron or steel. Consequently, when a part can be made from these metals at small labor cost, the expense will be less than for a die-casting.

An alloy to be used in die-casting must have a fusing-point and shrinkage that will not be so great as to injure the metals of which the dies and casting-machines are made. Metals when molten have a tendency to alloy with other metals coming in contact with them, even though such metals are far below their fusing temperatures. For instance, molten zinc in an iron pot will eat away part of the iron and gradually destroy the pot. Pressures applied during die-casting vary from 200 to 1000 lb. per square inch. The casting or pressure chamber must therefore have a high tensile strength at temperatures ranging from 800° to 1300°F. The metal to be die-cast must have, when solidifying, considerable elasticity, as otherwise it will crack in shrinking against cores in the die. Another important factor to be considered in determining the metals that may be die-cast is the necessity of maintaining the metal continuously in a molten state in the machine or in an adjacent crucible. With some metals this causes excessive oxidation and occlusion of gases and other impurities, and porous imperfect castings of low tensile strength are the result. This condition does not exist in sand-molding, as the molds are first prepared and the entire pot of metal poured in a comparatively short space of time. The die-casting machine operates only one mold, but works it continuously, requiring that a given quantity of metal be constantly in readiness for casting.



NUMBER-WHEEL DIE

The most satisfactory aluminum alloys for die-castings are the aluminum-copper alloys containing 5 to 20% copper. The addition of copper increases the tensile strength of aluminum and reduces the fusing point and shrinkage, all these things making the mixture more suitable for die-castings. Zinc strengthens aluminum more than copper or manganese, but the high temperature at which the metal must be maintained for extended periods causes it to burn out and dross excessively. Tin is not a satisfactory addition to aluminum, as it makes a brittle alloy, and is also expensive. Manganese-aluminum alloys, except for special purposes, possess no advantages over copper-aluminum alloys. Aluminum alloys, while costing more by weight than the cheaper and heavier white metals, do not as a rule cost as much by volume. Lead cannot be alloyed with aluminum. Iron below 1½ to 2% is not harmful, but if much more is present in aluminum alloys they will be brittle.

Pure zinc is not suitable for die-castings. When alloyed with tin, copper, or aluminum the shrinkage is reduced and the metal flows more readily. The proportion should not exceed 8% for tin, or 3½% for copper. Aluminum is a deoxidizer, but not more than ½% of aluminum should be added to tin-zinc alloys.

Tin when die-cast is usually combined with antimony, copper, and lead, or with one or two of these metals. It may also be cast pure. Tin alloys are not brittle, they have low tensile strength but are easy to cast because of their low fusing points and the fact that the metal flows readily in the dies. Small or delicate parts are for that reason often made in tin alloys. Their low shrinkage makes them accurate and tends to prevent cracks in castings.

The following alloys have been proved by experience to be the most suitable for most die-castings:

Aluminum, 90%, copper, 10%. Used for mechanical parts of all kinds. Tensile strength between 18,000 and 21,000 lb. per square inch. Less than half the weight of cast-iron. Not harmful to foods. Resistant to corrosion and atmospheric conditions, but becomes coated with film of oxide in presence of moisture.

Tin, 84%; copper, 7%; antimony, 9%. Highest grade genuine babbitt, for high speeds and medium loads.

Tin, 83%; copper, 5%; antimony, 12%. Used for delicate and very accurate parts. Tensile strength comparatively low. Non-corrosive and not harmful to foods. Not affected by atmospheric conditions.

Tin, 82%; copper, 6%; lead, 2%; antimony, 10%. Highest grade babbitt for high speeds and medium loads.

Tin, 61%; copper, 3%; lead, 25%; antimony, 11%.

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Can be used in place of the preceding mixture and is cheaper.

Tin, 81%; copper, 4%; antimony, 15%. Similar to the third alloy in the list, but harder.

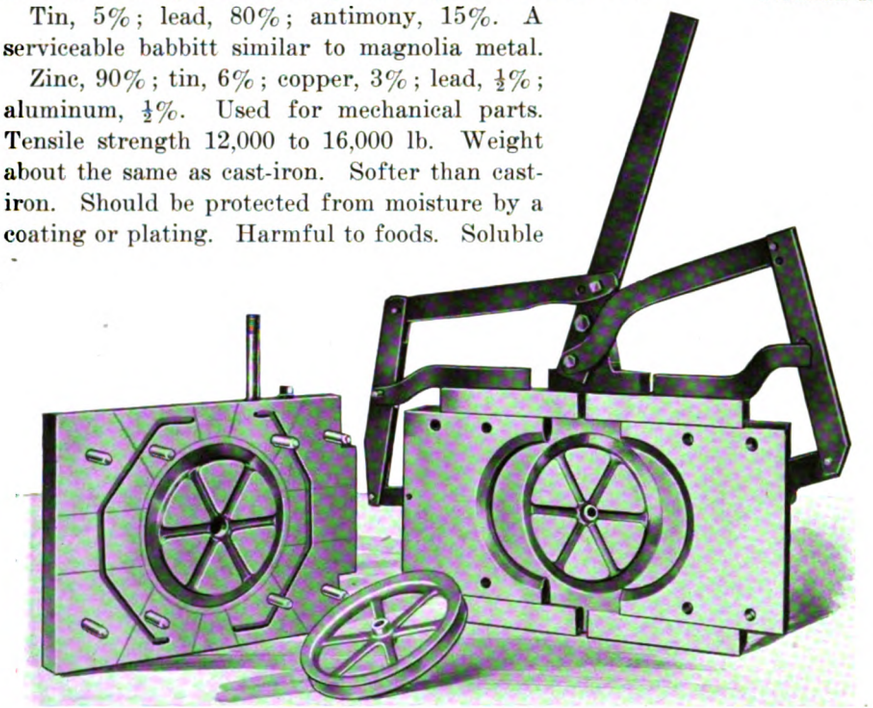
Lead, 87%; antimony, 13%. Standard low-cost anti-friction metal for light loads and medium speeds. Also used for mechanical parts not requiring strength. Harmful to foods. Not corrosive.

Tin, 15%; lead, 75%; antimony, 10%. A good low-cost babbitt for general purposes. Tougher and stronger than the preceding alloy.

Tin, 10%; copper, ½%; lead, 82%; antimony, 7½%. Similar to the preceding alloy but slightly lower in cost.

Tin, 5%; lead, 80%; antimony, 15%. A serviceable babbitt similar to magnolia metal.

Zinc, 90%; tin, 6%; copper, 3%; lead, ½%; aluminum, ½%. Used for mechanical parts. Tensile strength 12,000 to 16,000 lb. Weight about the same as cast-iron. Softer than cast-iron. Should be protected from moisture by a coating or plating. Harmful to foods. Soluble in alkalis and mineral acids. Non-magnetic. Should not be subjected to a greater temperature than 275°F.



PULLEY-WHEEL DIE. THE PART CAST FROM THE DIE IS SHOWN IN THE CENTRE. THE BELT-GROOVE IS FORMED BY TWO SLIDES, SHOWN IN OPEN POSITION.

Tin, 14%; copper, 3%; lead, ½%; zinc, 82%; aluminum, ½%. Similar to the preceding alloy, but softer and slightly more expensive. Frequently used for more fragile or difficult parts.

Inaccuracy in die-castings may be due to any one of a number of causes. If constant, it is almost always due to an error in the size of the die, or to a shifting or warping of the die-parts.

When inaccuracy varies in different castings and the error is across the parting-line, it may be due to particles of dirt or metal on the die-surfaces. In old-style casting-machines it may be due to wear in the clamps and toggles used to hold the dies shut, or else to their not being sufficiently strong to stand the pressure. Undue variations in die temperature, especially in large parts, also cause inaccuracy. Water-cooling will often prevent this.

All die surfaces coming in contact with molten metal must be polished for finish and to prevent the castings from adhering to the dies. Surfaces rubbed by the castings in ejection must have no tool-marks or depressions, and must be absolutely smooth, and slightly tapered to free the casting. Theoretically a casting could be withdrawn without draft, but in practice an absolutely true surface cannot be maintained without warping. As much taper as possible up to 0.005 to 0.01 in. per inch, should be allowed, since this reduces cost by increasing production and also strengthens the parts. When taper is objectionable, the following table of minimum taper per inch may be used as a guide:

	Inch
Hard tin and lead alloys	0.00025
Zinc alloys	0.0025
Aluminum alloys	0.003

Cores or slides passing through each other should be avoided if possible. A small core passing through a large core is likely to strike the larger core, raising a burr, or else injuring one or the other core. This will occur if the smallest particle of dirt prevents the larger core from taking its proper position. When the design cannot be modified to avoid die construction of this kind, it is usually better to machine or drill the part of the casting requiring the undesirable die construction.

Sharp inside corners should be avoided, as they cause shrinkage cracks and also weaken the part. Such corners should be filleted. Fillets should be as large as the design will permit, but a radius of 1/32 to 1/64 in. is sometimes enough.

Reinforcement by webs is better than by thickening walls. Outside or inside threads may be cast. They should be made as coarse as possible, as they are stronger, more accurate, and less likely to chip in casting. Gears operating at high speeds under loads subjecting them to heavy strains should not be die-cast. Gears in zinc and aluminum alloys cannot be die-cast with the same accuracy as they are machined. Spur-gears cannot be cast without taper on each tooth toward the parting-line of the die.

Frequently, when the metal from which a part is to be die-cast is not suitable for certain parts or functions of the die-casting, an insert of some other more suitable metal or material may be placed in the die and the metal cast around it. Inserts should not be used to strengthen a casting by embedding them entirely in the metal. The surface of an insert does not adhere to the casting by alloying it with the surrounding metal, but rests in the metal as if it were driven cold. Inserts should be large enough to be handled by the machine-operator who is obliged to wear heavy gloves for protection from the heat of casting.

Bronze, steel, or graphite bushings may be cast in the

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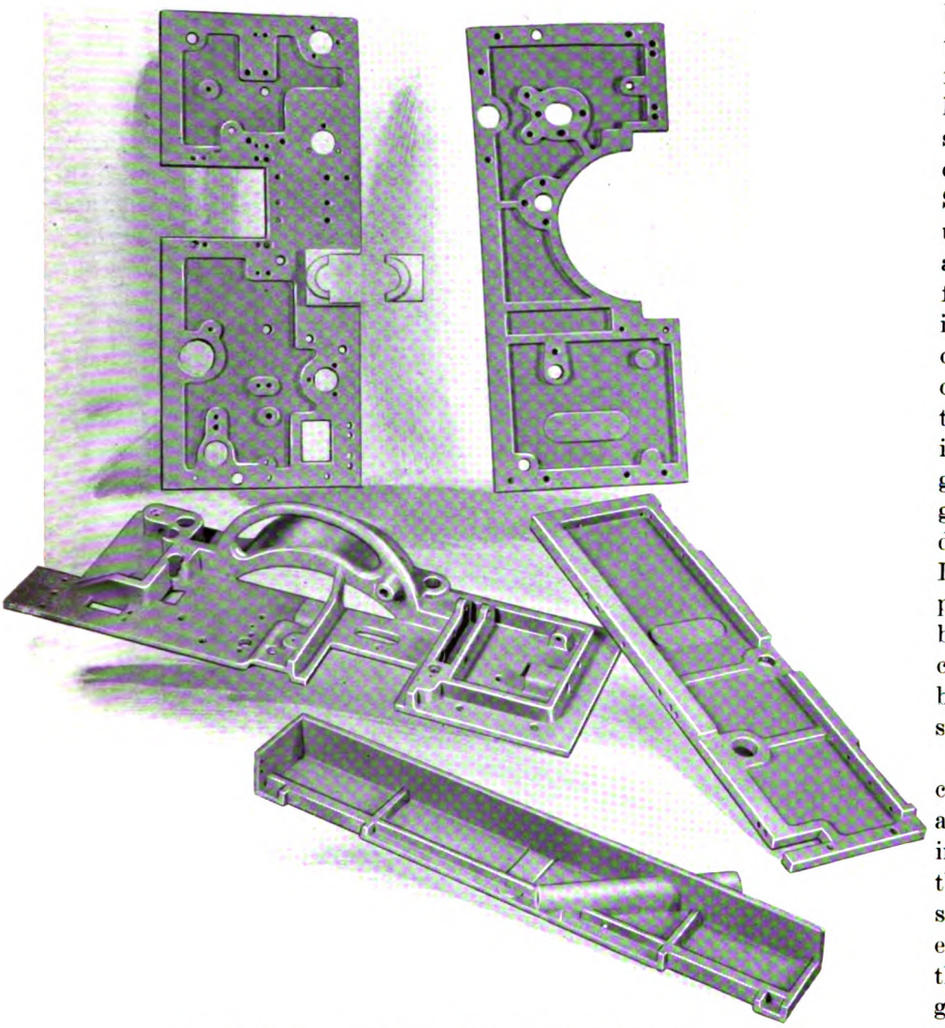
die-casting if a special bearing surface is required to provide for heavy wear. Such bushings may also be made from sheet brass or steel.

All die-casting processes employ a compression-chamber in some form, in which the metal is subjected to pressure while liquid, and from which it is forced into metallic dies. Various methods of applying pressure have been employed. Type-casting machines employ a piston traveling in a cylinder, and this method has proved satisfactory in casting metals melting at 950°F. or less. Compressed air is generally used when the melting-point is above 950°F. Centrifugal force is employed on some kinds of work. The pressure-chamber sometimes consists of the entire pot of metal, which is covered with an air-tight cover and heated with gas or oil fuels, or it may be immersed in an open pot in the form of a pump or a 'goose-neck' having suitable openings below and above the metal. The pressure is connected directly with the die or die-carriage by means of a nozzle.



ZINC-ALLOY FRAME-PLATES FOR MOVING-PICTURE MACHINE

The die may be in any position with relation to the pot. On some machines the pot is raised and the die operated underneath it. This requires the use of a valve to shut off the metal when the die is removed. When the die is placed above the pot, no valve is needed, but the metal must be forced upward into the die. Except for comparatively low temperatures, no valve has yet been devised that will operate satisfactorily in molten metal, on account of the wear and the action of the metal in eating away the surfaces of the valve. For this reason, operating against gravity is usually considered the lesser of two evils.

Some processes employ a vacuum to exhaust the air from the die just before the metal is poured, in order to produce denser castings. The results obtained with such processes have not been such as to compensate for the disadvantages that accompany the use of a vacuum. Since castings are made at pressures of 20 to 70 atmospheres, only an infinitesimal proportion of air from the die-space can possibly be included in the castings. The real cause of blowholes and similar difficulties in castings is the gases in the metal, and these must be eliminated or reduced by using high-grade pure metals and alloys that give off as little gas as possible under closely regulated temperatures. Die-castings of necessity are more porous than sand-castings, not only because the die does not allow escape of gas, while the sand does, but also because the die chills and solidifies the metal more rapidly.

Dies are usually mounted on a carriage on which they are opened and closed. The carriage is usually in the form of two plates, to which the dies are bolted. The plates slide on two or four bars. The general practice is to open and close the dies by hand by means of toggles and to hold the die-carriage to the nozzle of the machine with clamps, also operated by hand. This requires strength and endurance on the part of the operator. Skilled labor is also required, or the losses because of cracked and defective castings will be large.

The difficulty in applying power to die-casting machine operation has been the varied character of the dies to be used, and the necessity of holding the dies closed under high pressure. The mechanical action of a press would be unsuitable. Power-driven and automatic machines for use with tin or lead alloys for small parts such as type have been developed, but they are not practical for general use with metals having a higher fusing temperature.

There are two methods for feeding the metal into the

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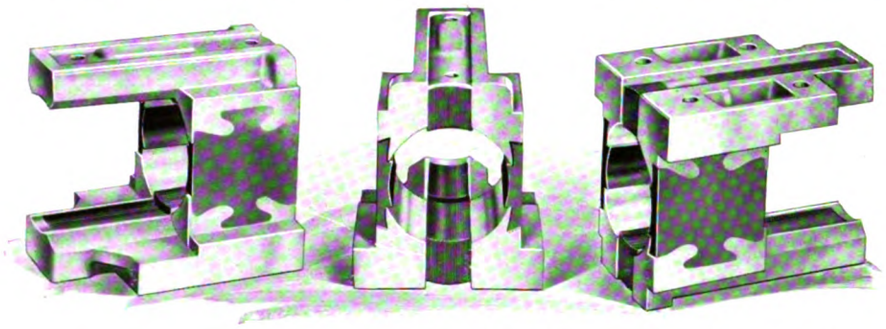
dies. It may be fed between the die-surfaces, the nozzle being placed at the parting-line. It may also be fed through the lower die-block, the nozzle being at right angles to the parting-line. In the latter case, a sprue-cutter or a gate-former is required.

A sprue-cutter is a rod or bar that passes through the die into the opening through which the metal enters the die. When the casting is made the sprue-cutter is raised free of the gate, and the instant the die impression has been filled, the sprue-cutter is pushed into the gate, closing it and cutting off the flow of metal. Since a sprue-cutter cuts off the flow of the metal, it also releases the pressure on the metal, and the moment the metal contracts, it is no longer under pressure. The beneficial effect of the pressure is lost on the unsolidified parts of the casting, and most important of all, metal cannot be fed to compensate for the contraction of the casting. This tends to make the centre of a heavy part porous and spongy. Lighter parts, however, do not show any appreciable difference when made with or without a sprue-cutter.



ALUMINUM MAGNETO-HOUSING. CAST-IRON POLE-PIECES CAST IN SIDES AND LAMINATED INSERTS CAST IN TOP AND BOTTOM

A gate-former is usually a tapered bushing attached to a handle which is placed in the die for each operation. It is placed between the die and the nozzle of the casting-machine. After the casting is made the gate-former is turned, usually on a cam so as to lift it out of the die. At the same time it breaks off the sprue or gate to permit ejection through the die-block.

Die-castings may be machined like other castings, due allowance being made for the peculiarities of the particular metals used. High-speed steels only should be used for cutting-tools. For zinc alloys, cutting-speeds should be 10% to 20% faster than usual, and for aluminum 20% to 40% faster. Feeds should be 25% slower.

The minimum clearance for tools should be 5%, and this should be increased for soft aluminum. When an end-mill is used, results will be better if every other tooth is cut back to a sharp angle, for instance, alternating between an angle of 70° and one of 40°.

Tap-holes should be from 0.003 to 0.005 in. diam. larger than for ordinary work. In tapping or reaming parts having thin walls, fixtures should be used that will grip the castings so that the walls will be supported against the spreading action of the tools.

As a cutting compound for aluminum alloys, a mixture of one part lard oil to three parts benzine is recommended, although there are a number of other good compounds on the market for aluminum. Zinc alloys do not require a cutting compound, although the use of one is frequently advisable. Any lubricant that will wash out chips and keep the tool cool will do, such as soda water, soap water, lard oil, or equal parts of kerosene and turpentine. In grinding or filing die-castings, the wheels or files can be kept to a considerable extent from clogging by applying tallow, chalk, or a mixture of both.

If a polished surface is required, buffing is necessary. For very fine work, the surface is first polished with No. 150 emery, which must be applied with a mixture of paraffine, beef suet, and carbolic acid. Dry emery would injure the surface. The castings can then be cut down with tripoli compound. In preparing castings for electroplating, the surface must first be cleaned of grease, oxides, and foreign substances, and the same procedure is required in preparing the surface for lacquers, enamels, and chemical finishes.

In soldering zinc alloys any low-fusing solder may be used, and a flux is advisable. For aluminum alloys a high-fusing solder is required. Metal-cements may sometimes be used instead of soldering. When little or no strain is put on the joint a putty of glycerine and lead oxide may be used. When greater strength is required, mix sodium silicate with zinc oxide to a putty-like consistence. After application dry for 24 hours and then heat to 150°F. for a short time.

Iron Ore and Coal in China

The iron industry in Shansi is the oldest in the world. The ore is, unfortunately, in irregular lenses, the average thickness being about 1 ft. Mining this ore by modern large-scale methods is therefore impossible, although much of it can and is mined by native methods. The estimated quantity in Shansi is 300,000,000 tons, although this quantity is necessarily approximate. In other parts of China there is approximately 300,000,000 tons more, of which at least half can be worked by modern methods. In 1915 the total production of pig-iron was about 300,000 tons. Of this amount, 136,541 tons came from the Hanyang Iron Works and 29,529 tons from the Sino-Japanese Coal Co. at Penshihu. The rest came from small native furnaces in various parts of China. Besides supplying the Hanyang works, the Tayeh mine exported 298,350 tons of ore to Japan. The estimated total production of pig-iron in 1918 is 500,000 tons. The iron-ore deposits are now controlled by either Chinese or Japanese interests, the Chinese government making efforts to obtain control of deposits not already mortgaged to the Japanese.

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Financing Import Trade With China*

IN commercial dealings with, or in, other countries than China, it is not always necessary to be acquainted with the internal working of the financial systems, since these peculiarities are usually relatively unimportant. In China, the price of an article is not only subject to the usual variations in value of the commodity itself, but is also affected by two other important factors, namely, the internal exchange, or the ratio between the various standards circulating in China as mediums of exchange, and the foreign exchange, or the ratio between any one of the silver standards of China, and any one of the gold standards of any foreign country.

The first factor is not always present, or, to be more accurate, is eliminated sometimes by the fact that handling of it is left to the Chinese compradore's staff, which is attached to every firm here, and which will undertake to quote a price in a recognized and reliable currency.

Internal exchange is complicated by the many different standards accepted in various parts of China. In the first place, there is the 'tael', which is not a coin, but a Chinese ounce of silver. Both the exact weight and the fineness of the tael are subject to many variations, and there are several hundred different taels, any one of which is the standard in certain districts. The 'dollar' is a silver coin, originally introduced by foreigners, but now also coined by the Chinese. Small silver coins and copper 'cash' also serve to complicate exchange conditions.

Because of these peculiar exchange conditions, the functions of the banks in China are much wider and more complicated than those of an ordinary bank. In dealing with foreign merchants the procedure is about as follows:

It is common practice for firms shipping goods to Chinese dealers to quote gold prices in order to avoid risk of the oscillations of the rate of exchange. In ordering the goods, the import firm may or may not open a credit at the banks in favor of the sellers, but this makes no material difference in handling the transaction. In either case, the bill and documents for the goods will be sent to a bank in China, either the bank opening the credit or the bank designated by the import firm. On the arrival of the draft and documents, the bank will advise the import firm, which, in turn, will notify the Chinese dealer.

In ordinary times, the documents will arrive some time ahead of the goods. As soon as the goods arrive, the import firm will ask the bank for the shipping documents and the firm will attend to clearing the goods through the custom-house, paying the duty and storage in a public 'godown' or warehouse, from which is obtained a landing-account to the order of the bank. This account is sent directly by the godown company to the bank itself. The Chinese dealer has the option of settling the exchange involved in the transaction.

As goods are generally ordered in large quantities, it is customary to allow the Chinese dealer to take delivery in partial lots, paying the proportionate amount to the bank. Suppose that 100 machines have been ordered originally, have been cleared through the custom-house and stored, and the Chinese dealer wants to take delivery on only 10 machines. To do so, he will obtain from one of the native banks, a 'native order' generally due in 10 days, for an amount in taels corresponding to the tenth part of the invoice price transferred from gold to silver at the settled rates plus charges and interest. This native order will be handed to the import firm, which will give a delivery order on the bank, sending to the bank the native order. The bank, after having ascertained that the native order is correct, will give a delivery order on the godown company to the Chinese dealer, while the godown company will make the necessary entries on the landing account. As soon as all the goods have been delivered, a certain amount in taels corresponding to the total of the original bill plus charges and interest will stand to the credit of the import firm. The bank will then retire the bill and make out the statement at the rates settled, plus interest, charges, and commission. The amount will be debited to the import firm's account and the difference between the two amounts will represent the import firm's profit or loss on the deal.

*Abstract from 'The Far Eastern Review'.

German Iron Production During the War

Statistics of German pig-iron production up to the signing of the armistice have recently been made public. The average pre-war production was about 1,600,000 tons per month. After the outbreak of hostilities, the output dropped to less than 600,000 tons per month, but recovered somewhat until in July 1915 it was 1,000,000 tons per month. It remained at about this figure until the armistice. Since then, the loss of Lorraine has reduced the output still more, and it is believed that the production from the rest of Germany is not so great as it was during the War.

Cost of British Ships About $115 Per Ton

'The Wall Street Journal' quotes Claude Bryan, a British shipbuilder, as saying that all the shipyards in England have contracts that will keep them busy for two years at least. Contracts are made on a 'cost-plus' basis, from 7½% to 10% profit being allowed to the builder. Under present conditions this arrangement makes the average cost £23 per ton.

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Opportunities for Trade in Siberia*

IT is difficult to give a complete list of all the manufactured articles for which there is a demand in Siberia, the wants of a population of over 13,000,000 being too manifold. Most Siberian supplies used to come from Germany and from European Russia. There are no industries in Siberia itself, and since all communication between Siberia and eastern Russia has been broken off, the only avenues open to commerce lead from the Pacific through Vladivostok and Dairen. Every kind of manufactured article may be placed on the Siberian market with good prospect of success.

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Conditions on the railroads are not as hopeless as is generally believed. It should be remembered that during half a year, from last June, when the Czecho-Slovaks started to clear the Bolsheviki from Siberia, until November, when the last Bolshevik bands were driven from the railroad zone, Siberia was almost absolutely cut off from the outside world, and traffic in the country itself stopped completely. The railroad, during that period, was used for military purposes only. Fighting has occurred along the entire line of the railroad, part of the track has been removed, bridges blown up, and cars and engines destroyed or carried into European Russia by the Bolsheviki. There is a demand for many railroad materials that formerly were imported, and the supply of which has been exhausted during the unrest. Under such conditions, it is no wonder that transportation on the railroads in Siberia is not being handled as efficiently as in former days. However, the good intentions of the Siberian people to work toward an improvement in their interior affairs are shown by the fact that imported articles appeared in quantities on the Omsk and Tyumen markets as early as December last. Since November transportation has improved greatly and by March, business transactions could be carried on with reasonable safety as far as Irkutsk.

As Siberia is mainly an agricultural country, the principal market is for agricultural implements of all kinds, dairying machinery, hardware, and small tools. In addition, since the purchasing power of the Siberian peasant has increased as a result of the War, there is a growing demand among them for articles formerly considered as luxuries.

The principal market is for agricultural implements, hardware, and small tools.

Although stocks of imported articles are now stored at Vladivostok waiting for shipment to Siberia, these are insufficient to meet the demand, and though goods are being received daily, prices continue high, and the profits to importers is large. Naturally, Japan is trying to succeed to the trade pre-eminence formerly held by Germany, and to flood the market with cheap goods, but she has little chance of success, as Siberia does not want cheap goods of poor quality, but is demanding American goods of high quality.

There are great opportunities for business in Siberia for American exporters, but not through haphazard and half-hearted efforts. Success demands careful study, constant watchful attention, and a greater investment of capital than would be required in some other fields. However, the amount of capital required is of less importance than efficient management and administration. Commercial success in Siberia is, above all else, dependent upon the representatives that buy and sell the goods on the spot. In fact, the foreign export trade to Siberia can be developed and retained only by placing competent representatives in the field.

The foreign export trade to Siberia can be developed and retained only by placing competent representatives in the field, not through agents.

The foreign exporting firm that wants to make good must have its representative on the spot, a man that knows the Russian language well, the local conditions, and methods of doing business, and who keeps constantly in touch with the Siberians. This representative must be able to select from the many new traders that are now coming to the principal towns those that are reliable and who deserve credit, in contrast to the many 'fly-by-night' traders, who are simply on the lookout for a chance 'to make a killing'. Moreover, he must be acquainted with the requirements of the Siberians, and must try to suit his customers as far as possible by supplying them with goods of the quality and kind they want. The taste and habits of the Siberians differ widely from those of the residents of some other countries.

The refusal of American firms in the past to deal on anything but a cash basis is one of the reasons why most of the trade in Siberia used to be in the hands of the Germans, who opened accounts on the following terms: 20% cash on delivery, 40% in one year, and the remaining 40% in two years. At present, the Siberian merchants do not expect such favorable conditions, and, in general, they are prepared to pay 30% when the order is placed and the remainder upon delivery of the goods, provided prompt deliveries can be assured. The reason for this is that prices for goods on the spot are abnormally high because of the complete absence of stocks, and the Siberian merchant is forced to accept hard credit terms in order to obtain deliveries. Permanent business relations, however, cannot be established unless credit is given to firms in good standing. Siberian business men have usually met their obligations but they have been accustomed to long credits, have

Siberian merchants are accustomed to long credits.

*Abstract from 'The Far Eastern Review'.

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often been granted extensions by the German firms, and they will look for similar terms as soon as shipments to Siberia increase with the resumption of normal conditions. It will not be sufficient for foreign merchants to inquire about the different firms from the local banks because conditions in Siberia have changed completely since the revolution. Many old firms have been practically ruined, others have ceased trading temporarily, and many new and promising enterprises are springing up, and of most of these the banks know little or nothing, since credit operations were practically stopped all over the country during the unrest on account of lack of money in the banks.

To establish permanent commercial relations with Siberia, foreign firms should first choose a competent representative with knowledge of the Russian language and send him to Vladivostok to investigate the present requirements of the Siberian market. Warehouses should be secured at that port and shipments made, not too large in order to avoid unnecessary risk. There is no danger that part of this stock will remain unsold, as the demand for every article exceeds the supply. Vladivostok is crowded with merchants from all parts of Siberia eager to purchase goods of all kinds. They recognize that an indefinite time may elapse before the goods bought by them in Vladivostok can reach their destination in the interior of the country, but they are thankful to get the goods anyway.

The first sales made by an American firm at Vladivostok would constitute the foundation on which future permanent business relations could be built. New firms entering the field will find it advisable at the start to limit their dealings to Government institutions and the various co-operative societies.

At a Welsh railway station that rejoices in the name of 'Llanfairpwilgwyngyll'—and about two yards more of it—a new porter was engaged.

He was only an Englishman, but he meant to do his duty.

The first train arrived. He tackled the name of the station, but failed miserably to pronounce more than about the first inch.

But he was a man of brains. Running along the platform he pointed to the board which bore the lengthy name, and yelled out:

"If there's anybody there for here, this is it!"

A young woman who was not familiar with the language of railroad-men happened to be walking near a depot where a freight-train was being made up. As the train was being backed up, one of the brakemen shouted: "Jump on her when she comes by, run her down beyond the elevator and cut her in two and bring the head-end up to the depot."

Screaming "Murder!" the young woman turned and fled from the spot for dear life.

Newly-Formed Steel-Treaters' Society to Hold Convention

The National Convention of the American Steel Treaters' Society will be held in the Seventh Regiment Armory, Wentworth avenue and 34th street, Chicago, during the week of September 22. The program committee, in charge of E. J. Janitzky, metallurgical engineer for the Illinois Steel Co., has arranged for papers and addresses on 'Heat Treatment of Steel' for purposes listed as follows:

1. Steel for structural purposes. (Buildings, bridges, etc.).
2. Steel for machine parts. (Stationary and moving parts). Oil treated or case hardened.
3. Steel for cutting purposes.

a. Plain and high-speed steel tools with constant contact, such as lathe cutting-tools, boring-tools, drills, and milling-cutters.

b. Tools for alternate contact, such as punches, dies, chisels, oil-well bits, and shear-knives.

4. Steel for electrical purposes. (Permanent magnets, etc.).
5. Steels for warfare. (Guns, armor plate, projectiles, etc.).
6. Wire steel-products.
7. Spring-steel. (Flat and coil.)
8. Sheet-steel.
9. Rail-steel.
10. Case-hardening in general.
11. Cast-steel.
12. Results of investigations pertaining to heat treating.

During the week of the convention and in the same building, the Society will hold an exhibit of heat-treating appliances and heat-treated products. The best exposition-building in Chicago with 26,000 sq. ft. of floor-space and all desirable adjuncts, has been engaged. The service of a competent exposition company has been engaged to equip, decorate, and arrange this show, and thus all of the visitors and exhibitors are assured of the success of the undertaking and of excellent service. At this exposition will be gathered all that represents the last word in materials, equipment, apparatus, instruments, and methods used by heat-treaters in their workshops, and in chemical and physical laboratories.

During the same week the American Institute of Mining Engineers will hold a meeting in Chicago, and the National Chemical Exposition will also be held at the Coliseum. As there is much of common interest in all of these activities, the convention and exhibition of the steel-treaters is sure of a large attendance. This is the first national exhibit of heat-treating appliances and products ever held in the United States, and it is impossible to estimate the value of the gathering, not only from an educational but also from an advertising and selling viewpoint.

Arrangements for the convention and exhibition are in charge of A. J. Murphy, 154 East Erie street, Chicago.

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Melting of Nonferrous Metals and Their Alloys in the Electric Furnace*

By E. F. COLLINS

SATISFACTORY and economical melting of nonferrous metals and alloys requires a furnace with the following characteristics:

1. Freedom from oxidation of metals or alloys while in the furnace, in fact deoxidation of metals or alloys in some degree is usually advantageous.

2. Freedom from volatilization of metals should exist subsequent to their liquefaction and while in the molten state, to prevent loss of metal in the form of escaping vapor, which usually oxidizes upon its escape from the furnace to the air, provided the furnace atmosphere is neutral or reducing.

3. Freedom from slags during melting. These slags come from over-heated linings, dirt from scrap, and oxides from metals. The furnace should not require the maintenance of an elaborate and expensive reclaiming plant. In other words, the impurities should float on top of the bath in the furnace, in dry powdered form so that they may be skimmed from the surface of the bath. The design of the furnace should permit the use of sal ammoniac or other flux to aid in cleaning the metal while molten in furnace, but should not regularly require the use of such flux to give perfect metal, neither should the bath require charcoal covering while melting, or subsequently, while held in furnace.

4. Uniformity of alloy and absence of segregation should exist when the furnace-charge has reached the pouring-stage.

5. The furnace linings and atmosphere must be free from sulphur, and the furnace atmosphere must be controllable as regards oxygen when melting copper and many alloys rich in copper.

6. Large-capacity furnaces that do not require crucibles are desirable where local conditions will permit. Large furnaces promote economy, because of higher thermal efficiency, saving in floor-space in proportion to metal melted, saving in labor, saving in cost of lining per ton metal melted, especially when compared to crucible costs. Furnace-linings should in the main be built from commercial refractories, such as standard firebrick and shapes, with limited use of special refractories where the results justify their usage. If the foundryman will repair his linings at least once every two weeks, and for severe service once a week, his lining cost will be much less than when special high-priced refractories are used and repairs and inspection of linings are less frequent. The refractoriness of a lining should be such that it will not fuse or slag perceptibly at melting temperatures.

7. The melting-chamber should be arranged so that its atmosphere may be reducing, neutral, or oxidizing for certain metals and alloys, in other words, its oxygen should be controlled.

8. Shallow baths promote a more uniform and rapid melting and freedom from segregation than the deep bath. The source of heat should be a uniform mild 'soaking' heat, and its temperature gradient above the bath should be moderate. A safe way in securing this heat control is to limit the temperature of the heat source by means of a pyrometer. It follows from the above that furnace design should be such as to allow the source of heat to be held at any temperature desired.

*Abstract of address delivered before the Cleveland Engineering Society.

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9. Dependability and continuity of operation is necessary.

10. Heat distribution should be fixed and if possible automatically controlled.

The foregoing sets forth the requirements for economy in melting brass alloys. It is now desired to consider the characteristics of the electric furnace and also to compare it with the fuel-fired furnace. Electric furnaces may be classified as follows:

1. Furnaces in which heat is developed by the passage of current through a solid, laminated, or granular conducting medium or resistor.

a. The conducting medium may consist of material that is to be treated.

b. The heat developed in the resistor may be transferred to the charge by conduction or radiation or both; a wall may or may not intervene between the resistor and charge.

c. A readily controllable amount of heat may be generated between a fixed and a movable carbon electrode, the distance between electrodes being maintained such that the granular carbon lying between the faces, gives rise to many chains of series and multiple contact or resistance arcs, enveloping adjacent electrode faces.

2. Furnaces in which heat is developed by the flow of current through a liquid or solid conductor.

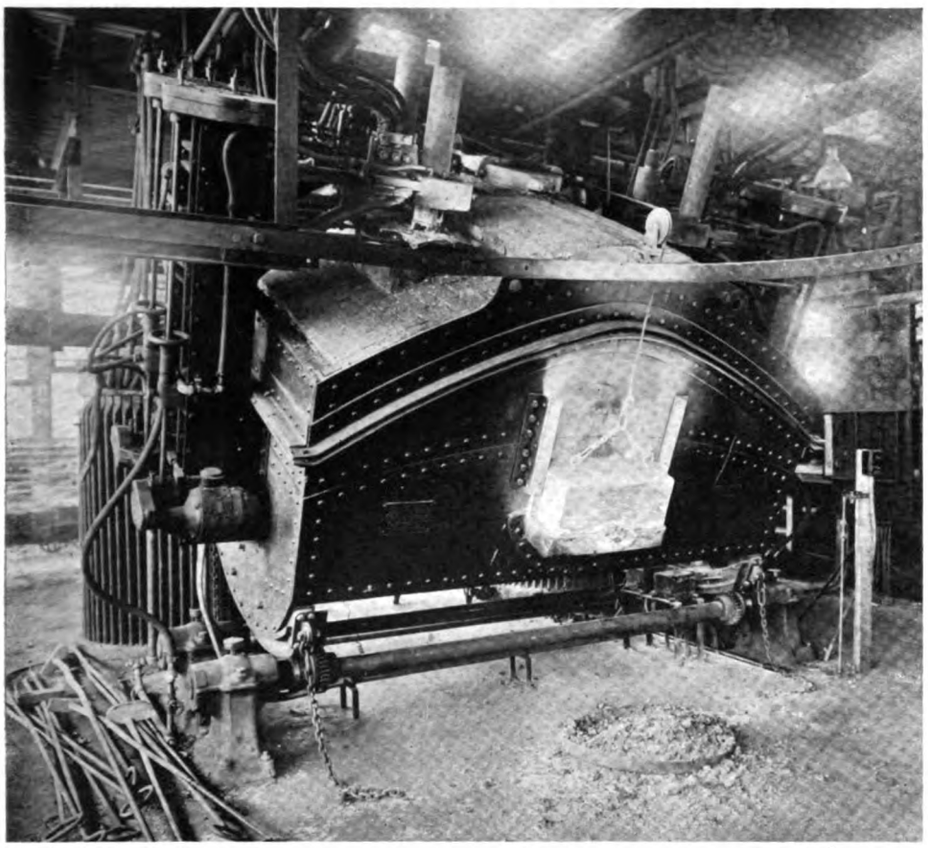
a. Electrolytic.

b. Non-electrolytic.

3. Furnaces in which heat is developed by flow of current through gas or air.

a. Arc-furnaces in which arcs play between two or more electrodes, near material to be heated or between one or more carbon electrodes and charge to be heated.

In the making of brass, furnaces in each of the three classes have been tried. Furnaces in Classes 1 and 2 lend themselves readily to the generation and control of a mild 'soaking' heat such as is required for melting volatile alloys. The common resistance-furnace belongs in Class 1, and the induction furnace in Class 2. Furnaces in Class 3 generate too intense and burning a heat to be used in melting volatile alloys. Control of the electric arcs in atmospheres high or low in volatile gases, freedom from surging, and low power-factor and high metal loss are some of the serious problems confronting the man who would melt volatile alloys in the Class 3 arc-furnace. Their employment had best be left for steel.



1500-POUND 300-KILOWATT BRASS-MELTING FURNACE

I have had several years' experience with furnaces in Class 1 and Type *c* of the above classification and it is upon experience gained from many tests as well as upon commercial operation in the foundry that this paper rests.

This furnace consists essentially of a refractory-lined case within which are placed in the same chamber the heating units on either side of the melting-hearth. The furnace is two-phase. By multiplying the two phases, however, it may be operated single-phase, or by using Scott transformer connections it may operate from a 3-phase source. The phase-voltage most satisfactory for all conditions of operation has been found to be 60 to 70 volts.

Some of the characteristics of this furnace that render it suitable for melting non-ferrous metals and their alloys are as follows:

1. The temperature of the heat-generating source is controllable at will.

2. The heat generated is of the mild 'soaking' type uniformly distributed, and any workable temperature-gradient may be maintained between the charge and the heat-source.

3. The heat is received by the charge from above, on the sides, and through the bottom.

4. The bath is comparatively shallow and a large sur-

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face is exposed to receive heat. The bath depth is approximately 6 in. in a 1500-lb. furnace.

5. The furnace has normally a reducing atmosphere, which may readily be made neutral or oxidizing.

6. The power-control is automatic, requiring little attendance.

7. The furnace atmosphere is free from contaminating gases.

8. 'Dead-atmosphere' practically restrained from escape exists normally in the furnace.

9. The temperature is controllable, so that slags do not form in melting brass. Consequently, recovery of metal from dirt skimmed from the top of the bath is simple.

10. The furnace may be 'forced', that is, heat may be 'fed' to the metal as fast as it is absorbed. A high rate of melting may be obtained with all its advantages and none of the disadvantages found in fuel-fired furnaces.

11. Continuity of operation is obtained. Operating records show that delays caused by the furnace are relatively unimportant.

Certain factors influence the overall cost of melting and must be considered in making up true melting costs. These will now be considered and their effect shown upon costs.

Sources of Metal Loss in Melting

	Electric	Fuel-fired
1. Temperature control	Excellent	Indifferent
2. Size of charge	Controllable	Controllable
3. Gas flow from furnace	Negligible	Large volumes of combustion gases must pass out
4. Chemical condition of furnace atmosphere	Free from oxygen and injurious gases	Contaminated by impurities of fuel. Protection against oxygen only through excess fuel supply
5. Speed of melting	Much greater than fuel-fired	Much less than electric

Illustrating how lack of temperature-control may increase metal losses in melting brass, let me present the following test: (1) 70-30 brass was made in the electric furnace taking 420 lb. of copper, melting, and then adding 180 lb. of zinc, at 1170°C., pouring at 1150°. (2) 420 lb. of copper was melted down and 180 lb. of zinc added at 1100°C. and pouring at 1100°C. with the following tabulated results:

In a given electric furnace, pounds of metal lost in melting increases as the temperature for forming alloy lies above melting point of alloy.

Table I

Number	Alloy recovered, lb.	Zinc loss, %	Metal loss, %
1	565	19.0	5.8
2	590	5.6	1.6

The pounds of metal lost on melting is independent of the charge in a given electric furnace, free from ventilation.

Metal melted, lb.	Charge, lb.	Temperature of melt	Metal loss
2696	674	1100°C.	1.4%—37.6 lb.
3727	932	1200°C.	1.3%—38.4 lb.

In the fuel-fired furnace the magnitude of loss from gas-flow from the furnace is influenced by speed of melting and by pressure and volume and velocity of gases flowing over the metal; thus increasing the atmospheric pressure in furnace and decreasing the volume and velocity of the gases tend to reduce volatilization loss. For each fuel there is a maximum limit to gas speed or velocity through furnace, since each fuel in developing the required heat units to get the heat out at a given speed must develop a certain volume of gases which must pass out of the furnace. The approximate volume of flue-gases averages in coal, coke, and oil furnaces from 3350 to 5800 cu. ft. per 100 lb. of metal melted. Hence, the flow of gas may cause a large volatile loss in the fuel-fired furnace. In the electric furnace the gas flow is small and, consequently, though its atmosphere be saturated with metal vapors, so little gas leaves the furnace during the melt that the loss is negligible.

Copper, zinc, tin, and lead, the constituents of commercial brasses, are all readily oxidized at the temperatures to which they must be heated for melting and pouring. Oxidizing causes loss of metal and actually burns the metal to a dross. One can readily maintain a neutral or reducing atmosphere in the electric furnace, but it is certain that carbon monoxide must be so high and oxygen so low that one cannot, in ordinary fuel furnaces, hope to maintain a reducing atmosphere without sacrificing many heat units through burning carbon to carbon monoxide instead of dioxide.

Gas absorption is proportional to the temperature and the time the metal is held in contact with gases. When metals freeze, absorbed or dissolved gases are released. If these gases are unable to pass through the metal before it freezes sponginess and blow-holes in the alloy will be produced. The same effect may be produced by air trapped in pouring and by gases evolved by molds or cores when hot metal enters them, but dissolved gas is an important cause of porosity and blow-holes. All fuels used in foundry work at the present time contain some sulphur. This sulphur is a common cause of trouble. Melted brass absorbs sulphur greedily and releases it upon cooling, causing porosity and blow-holes. The above troubles should not occur with electric melting, since the furnace-chamber may be kept uncontaminated and free from oxygen and injurious gases.

Loss of zinc is proportional to the temperature and length of time metal is held at the high temperature. Thus, if you melt one charge at the rate of 100 lb. per hour, and a second charge at the rate of 200 lb. per hour, then other things being equal, the melting-loss for the second charge will be less than for the first charge. Much quicker melting is feasible with the electric furnace than with fuel-fired furnaces.

In conclusion permit me to present the following table. Here I have assumed that all the brass in the country is melted (1) in fuel-fired furnaces, all types being employed equally, (2) that the same work is done in the electric furnace.

Furnace	Alloy	Length working day	Saving, electric over fuel-fired
Electric	Yellow brass	10 hr.	100%
Electric	Red brass	10 hr.	80%
Electric	Yellow brass	24 hr.	110%
Electric	Red brass	24 hr.	700%

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The Use and Abuse of Crucibles

By A. C. BOWLES*

A FEW DAYS ago, a local foundryman called me up and complained, in language more forceful than elegant, that the last batch of crucibles he had received 'was rotten' and that they fell to pieces before he was able to get even one heat out of them. He asked indignantly what we were going to do about it. Of course, I told him that I was sorry he had trouble and that we would make good any crucibles proved defective, but that I would like to see the crucibles to determine, if possible, the cause of their failure. To make a long story short, he had attempted to dry them in the moist atmosphere of the core-oven, with the inevitable result that they had scalped upon coming into contact with the fire.

Crucibles respond so readily to proper treatment, that it is worth while emphasizing again the few points that have to be observed if the maximum of service is to be obtained from graphite pots. There is nothing new about the right procedure. Most crucible users have known it, but probably on account of the stress of business during the past few years, have neglected to make use of their knowledge.

The manufacturer is not infallible and occasionally a bad batch of pots slips through, but the complete system under which he works, and the long years of practice in repeating the same operation, reduce the chances of mistakes on the part of the factory to the minimum. It is safe to say that 90% of the failures of crucibles are traceable directly to poor treatment on the part of the user.

The principal cause of the failure of crucibles is the lack of proper annealing. When the crucible comes from the kiln it contains but ¼% of combined moisture, and in this condition it is impossible to scalp it. However, during transportation from manufacturer to user, it, like salt, absorbs moisture from the atmosphere, and once absorbed a temperature of not less than 250°F. is required to dispel this moisture.

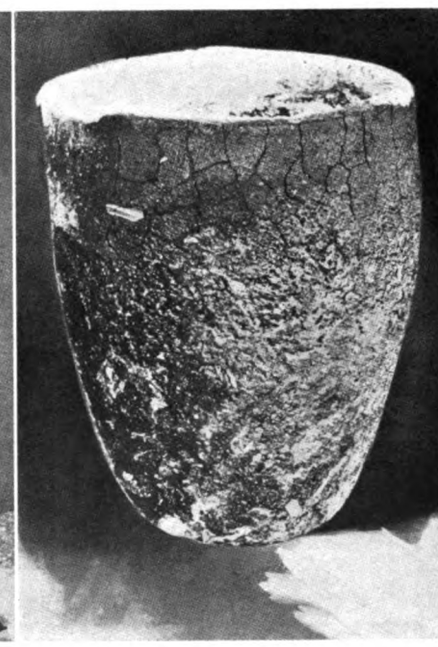
Most crucible troubles occur in small shops. The large consumers have found it well worth while to equip their plants with drying-ovens especially to dry and anneal their crucibles before they are put into the furnaces. Whether annealing in a special oven or on top of the crucible furnace, there are four points that must be observed.

1. The temperature must go above 250°F.
2. This temperature should be reached gradually.
3. This temperature must be held a sufficient time to allow the moisture to thoroughly disappear.
4. The crucible must go into the fire with a temperature above 250°F.

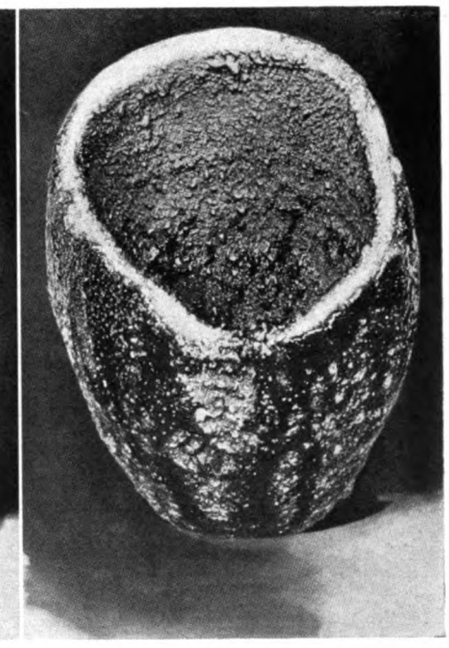
It is a mistake to think that after the first three rules

*Pacific Coast manager for Dixon Crucible Company.

CRUCIBLE BURST IN FIRE ON ACCOUNT OF MOISTURE



RESULT OF ALLOWING FLAME FROM OIL-BLAST TO TOUCH CRUCIBLE



CRUCIBLE SQUEEZED AND RUPTURED BY BADLY-SHAPED TONGS

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have been followed, the crucible has had its annealing and is impervious to moisture, for, if allowed to cool below 250°F. it will again take up moisture just as readily as the first time.

Another enemy of the crucible is mis-shapen tongs. When the crucible is hot, it is in a somewhat plastic condition and is easily squeezed out of shape or ruptured. The best tongs are the basket variety which grab the crucible both below and above the bilge and hold it firmly without squeezing. It has been found good practice to have an iron crucible cast, over which the tongs can be straightened and shaped at frequent intervals. This method is not only much quicker and simpler, but gives a better result than sending to a blacksmith. Some shops find it advisable to have tongs of two sizes; one for the new crucible and one for the old pot, which is considerably smaller.

In using an oil-furnace, the flames should never be allowed to play directly on the crucible, as scoring will follow, and the crucible will soon wear through on that side. In addition, one side will heat faster than the other, which is also bad practice. Oil-furnaces giving a rotary flame, seem to be the most satisfactory and to give the most even heat on all sides of the crucible.

The use of wet coke is also bad practice because steam comes in contact with the crucible and forms checks known as alligator-cracks. These will likewise form when a crucible is exposed to the moist gases on top of the furnace, while it is being annealed. Therefore care should be taken when annealing a crucible on top of the furnace, to see that it is kept away from direct contact with the flame.

The activities of the furnace-tender with his iron poker often shorten the life of the crucible. Many shops make a practice of keeping account of the number of melts each tender gets from a crucible so that the careless tender can be checked, and the average number of heats increased.

The number of heats obtainable from a crucible depends largely on the metal to be melted, and on the temperature required for the melt. A crucible that will last only three or four heats with nickel will last 25 heats with copper, or 40 or more with composition metal. If a flux is used, it lowers the life of the crucible by attacking the clay that holds the graphite together.

In general poor results are caused to a large extent by poor treatment. More attention to the details of storing and annealing the pots and to their treatment while in the furnace will pay large dividends in the increased service obtained.

A GEORGIAN from the mountains came to town with a lood of produce to exchange for groceries. As he neared the city he saw a sign: 'Speed Limit 15 Miles an Hour.' Prodding his oxen with a stick, he muttered: "By golly! I don't believe we can make it."

POURING A 15-TON LOW-PRESSURE CYLINDER AT THE PACIFIC FOUNDRY

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The Lowest Bid

By M. G. JEFFRESS*

IN addition to the incalculable value of the lives sacrificed, it has cost over one hundred billion dollars to demonstrate that the doctrine of 'German Efficiency' was a myth. It is costing the producers of the United States annually an appreciable proportion of this sum to maintain an equally mythical, even if not so vicious, doctrine, namely, the efficiency of the lowest bid. Competition is in all truth the life-blood of trade, but when its corpuscles fade into a pale pink from a too liberal infusion of such 'hop' as the Lowest Bid it is time for a change in diet.

"You can't make a silk-purse out of a sow's ear," remarked Noah in disgust when he caught the lowest bidder on the Ark construction trying to run in some unseasoned timber. Whereupon he promptly re-let the job to a builder with a reputation whose figure was 25% higher. This will be news to some of the old man's present-day descendants.

It is a far cry from the day when the price of a manufactured article was determined by what the individual fabricator could wheedle out of the individual buyer at the village market-place. There was then scant temptation or opportunity for the manufacturer (an individual) to sell grossly inferior goods to a market consisting of two or three individuals all 'from Missouri' and on the spot. Today it is vastly different. The last two centuries' development of the means of communication and transportation, from the absolutely primitive up to near-perfection, has created literally a world-wide market for all producing communities.

The nature and size of modern constructive enterprises demand competitive bidding. No other method could cope with the situation. The grave trouble is that along with competitive bidding has sprung up that weird theory, falser than the 'German Efficiency' stuff the world has lately disgorged, that the lowest bid is the best bid. Any business executive will frankly concede that the lowest bid in probably a majority of instances is the result of sloppy calculation, and in too many instances the product of sloppy calculation and a willingness to defraud. He will concede that it often spells an ultimate loss to all parties concerned. He will concede these things readily enough if merely generalizing on the subject of prices. But put this man at his desk to decide between the bid of A, a firm with a reputation for honest values and a knowledge of its own costs, and the bid of B, a firm of contrary repute and capability, and what does he do? If A's bid be 10% higher than B's, that 10% higher initial cost has more than an even break of shoving quality and service into the discard.

If this is likely to be the case where the award is made by the executive head of a firm, how much more likely when the decision lies with a salaried purchasing agent. The purchasing agent has got to show that he has saved money. Well, he can show it, can he not, if he awards the job to B for relatively 10% less than A's figure? Moreover if he is independent enough to give the job to the higher bidder, more than likely he will have a life-sized job awarded to him in turn, that of explaining to his superiors just why he had the infernal crust to pay A more than B for the same work.

Simmered down, the general situation is about as follows: Modern business calls for competitive bidding; the most conspicuous feature of a bid is the price in dollars and cents—the most important feature is the character of the commodity or service to be received; the decision is usually with an executive (board or individual) or with a purchasing agent; an executive suffering from low economic discernment will see only the conspicuous feature—the lowest bid; a purchasing agent buying for an executive of low discernment will be forced to the same action regardless of his own keener perception. It is plain that first, last, and all the time, the buck is up to the executive. Until modern business management in general recognizes that the halo of sanctity over the head of the Lowest Bid is an economic mirage, honest business will continue to suffer.

Any commodity or service that is inferior to what it purports to be is essentially dishonest and truly uneconomic. The firm that accepts such commodity or service knowingly is obviously injuring itself, and if it, in turn, is selling the commodity or service to a third person, it is equally culpable with the original producer.

You cannot produce a quill-less porcupine by a Burbankian method of breeding. Neither can you expect to eliminate from competition the substitutors of inferior materials and inferior labor by preaching business honesty. There is one way, however, by which dishonest competition can be eliminated to a large extent and that is by creating a more wide-spread understanding of the elemental truths that the important feature in the purchase of a commodity or service is the character of the commodity or service and that the bid price is only an apparent cost. The concrete problem is to get the buying public to go beyond rendering mere lip-service to this principle and to put it into daily practice. Let executives investigate first of all the all-important question of what they are going to get for their money and let them lay down this policy as the first rule of guidance for their purchasing agents. The question of initial price will adjust itself.

The increase of wealth in the United States in three short centuries from a warehouseful of wampum belts to $200,000,000,000 has brought with it a brand of fake efficiency that has resulted in the wholesale cutting down of both the safety factor and the lasting quality of an innumerable list of manufactures. It is appalling to observe the increasing inferiority of a large proportion

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of American manufactured products and the increasing proportion of inferior manufactured products. "Made to sell," remarks the buyer with a shrug when the article blows up. And then he trots back and buys another like it. Like the article, he too was "made to sell."

A few weeks ago this community, the State, and the Nation suffered the loss of an old gentleman whose whole life has been a conspicuous example of 100% quality of service. Among other things, he left behind him, as a monument to his sagacity and uncompromising personal and business integrity, a certain engineering installation in which the safety factor was so high that it withstood the earthquake of 1906, when less stable construction would have failed and caused immense financial loss to his company. His invariable rule in awarding construction work was to make sure of one thing—that the commodity and the service should both be 100%. Whether that meant paying the price of the lowest bid or the highest bid was a matter of complete indifference to him. And to the everlasting credit of his directors it was equally a matter of indifference to them. When the buying public gets this point of view it will begin to stop losses.

Book of a Thousand Excuses for All Persons Connected With the Foundry Trade

VOLUME II

CHAPTER I—Pattern-makers' excuses for asking for a raise in wages.

CHAPTER II—Foundry-owners' excuses for reducing the price of castings.

CHAPTER III—Pig-iron dealers' excuses for non-delivery of castings on time.

CHAPTER IV—Draymen's excuses for non-delivery of castings on time.

CHAPTER V—Foundry-supply men's excuses for poor material.

CHAPTER VI—Chemist's excuses for delay and wrong dope.

CHAPTER VII—Salesman's excuses for not getting more orders.

CHAPTER VIII—Foundry night-man's excuses for falling asleep on the job.

CHAPTER IX—Foundry cost-expert's excuses for giving the wrong information.

CHAPTER X—Foundry-worker's excuses for not wearing goggles.

CHAPTER XI—Labor leader's excuses for calling a strike.

CHAPTER XII—Foremen's excuses for laying off a workman.

CHAPTER I

Pattern-makers' excuses for asking for a raise in wages.

1. Needs the money.
2. Tastes run higher than the average workman.
3. Requires more high-priced brain-food on account of the brain work.
4. Laundry bills are higher on account of making neat appearance.
5. Molders can't work without pattern.
6. High cost of pattern-making tools.
7. May not have steady work.
8. Swallow a lot of sawdust, may not live long.
9. World almost filled up with patterns.
10. Especially heavy work.
11. Have to stand up all day.
12. Large family at home to feed.
13. Hard on the eyes to read blueprints.
14. Pattern-making one of the fine arts.
15. Smell of boiling glue hard for lungs.
16. Wood alcohol for shellac not good to drink.
17. Redwood stains a fellow's hands. People think he works for a living.
18. Great danger of being cut by hand-saw in case a fellow gets drowsy.
19. Patterns last too long.
20. No pattern-maker lives more than a hundred years.

There are many more legitimate excuses showing conclusively why the pattern-maker is under-paid, and should have all the raise he can get. The sky should be the limit. Moreover it would be a good idea for any one contemplating the purchase of patterns to make arrangements with the U. S. Subtreasury or the Federal Reserve Bank before placing his order for patterns. Otherwise he may be obliged to face a riot. It is quite natural for the living expenses of the pattern-maker to be higher than his co-workers. The pattern-maker must have his fried mushrooms and apple-pie a la mode while the laborer grows husky on boiled potatoes and macaroni. Feed a pattern-maker on macaroni and your patterns would be all out of shape. Of course the metal-pattern maker has somewhat the advantage over the wood-pattern maker as his material does not work so easily and he could possibly get by on a diet of fried onions and doughnuts, thus cutting the H. C. L. He is not obliged to wear a boiled shirt and stiff collar at work, which is a point in his favor. The pattern-maker can easily figure out how the other fellow can get by, but not in his case. The reader is no doubt convinced of this fact. The other trades will be taken care of at a later date.

Our next chapter will be 'Foundrymen's Excuses for Reducing the Price of Castings'. All foundrymen, young and old are requested to contribute their excuses for the next issue.

C. J. P. H.

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A Few Remarks on the Foundry Apprentice of Today

By JOHN HEDLEY

THE subject of apprentice to the molder's trade is, at present, a very important one. The situation has been acute for some years past, but now has arrived at the point where something must be done to keep up the supply of skilled men to carry on the work.

Modern manufacturing has done much to bring down the standard of skill of the molder, because the great quantity from one piece makes a repetition *ad infinitum*, and with the advent of the jar and squeezer has enabled manufacturing concerns to get out such work, assisted by molding machines, with a comparatively unskilled class of molders. A few weeks' training will enable any average man to get along where he has but one kind of casting to produce, but such operators never in the true sense of the word become molders.

At present, here in San Francisco, we do not train enough molders to replace the inevitable losses from death, disability, leaving the trade to follow some other calling, politics, or other causes, and even the apprentices often do not serve out their time, but quit and go to something they like better. Consequently we have to trust to molders coming from other places. A very large proportion of these visitors know little more than the rudiments of the trade so that the foundryman employing such men has a steady loss in both quantity and quality of work turned out. During the War, it has been a difficult task to induce boys to become apprentices in the foundry on account of the ease of obtaining a job in lines of industry other than foundries, and the exceptionally high wages that have been paid for some time past. It is true that the majority of such jobs have not much promise in the future but nevertheless they are attractive to the average boy, so, in consequence, very few applicants have appeared in the foundries.

Another factor in the case is the unwillingness of the high-school graduate to take up the foundry trade for his life work. His education is of little advantage at first, and is only of use after making some progress in the work. On the other hand, if he follows mercantile pursuits his knowledge is of use from the beginning. Moreover if he becomes an elevator-operator, janitor, or bill-clerk he can have an easier and cleaner time, with higher wages than if he becomes an apprentice in the foundry. On the other hand as a molder there is always a certainty of high wages, which those other occupations do not offer.

This would seem to show that younger boys are about all that we can expect to submit to the discipline necessary to the learning of such a difficult and skillful art as molding. This idea is further borne out by experience here in San Francisco, in the case of such of our young men that have been taught the trade while they were still young. A number of these men are of Portugese, Italian, or other southern European parentage and a large proportion of our best molders today are drawn from these sources. It might be mentioned here that the steady stream of skilled mechanics that used to come from Europe, is now dried up and is likely to continue to be so for many years, as that class of people is in great demand over there at present.

The man apprentice, on the other hand, does not appear to give good results, for after a year or two, he moves elsewhere and does not finish his time. In any case he cannot be looked upon as a means of keeping up a high standard of mechanical ability. In my experience few men that started to learn the trade after they were grown have become expert.

The Federal government has awakened to the lack of skilled mechanics, which shortage was shown clearly during the War, and is now taking steps to improve the situation by appointing a commissioner and staff, to look into this matter and to devise some scheme by which we can maintain our industries on a level high enough to compete with other manufacturing nations. This commission does not confine its activities to the foundry alone but its field includes the machine-shop, and the making of tools, rubber goods, shoes, and other articles.

One of the principal objects is to place foundry work on a higher plane than it at present occupies, and of which it certainly is worthy, for the molders' art in its higher branches is a difficult, and one might almost say artistic occupation, in learning which the student has to practice many years before becoming proficient.

The commission proposes that instruction be given the apprentice in loam, dry-sand, green-sand molding and core-making, also a good training in cupola-practice, the metallurgy of iron, steel, and brass, the reading of drawings, and the computation of weights of castings. If they meet with any degree of success, we may look forward in time to having a high grade of men in the foundry. However, this condition, so much to be desired, will not come of itself. We will have to do the best we can ourselves, and incidentally help Uncle Sam in his efforts to give our craft a higher and more dignified standing.

One thing might be tried, and that is to start an apprentice on a more liberal rate of wages than has heretofore prevailed, not less than $60 per month. This, I think, would tend to get a better class of boys to consider the foundry as a means of gaining a livelihood. The man apprentice is usually started at laborer's wages, which at present rates will run over $100 per month, and as mentioned elsewhere in this article, such apprentices cannot be considered a success in carrying on the foundry trade.

There is one weak point in the apprentice system,

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namely, that after becoming to some extent proficient, apprentices leave the shop where they have been taught all they know, and go elsewhere in an effort to get more money. This is a great injustice to such a shop, because a boy is far from profitable at first, and it would be nothing more than justice if the apprentice should serve out his time in the shop in which he started to learn the trade.

It might be of interest to mention here that Portland has had for some time past a trade school, well equipped and with no expense spared to do good work, but this has, up to the present time, not shown as good results as might be expected, principally, I understand, on account of prejudice against such an institution by the workingmen, themselves, who seem to think such places will turn out too many mechanics and flood the trade. So we must take it for granted that any school or other innovation on old methods will have to be supported earnestly or no good will result from such schools. Personally, I think the apprentice can be taught molding better in a good foundry (not a manufacturing concern for there is too much repetition there), with regular commercial surroundings. The other studies such as cupola-practice, metallurgy, drafting, and computing, can best be handled by the commission.

When the commissioners start their labors let us give them our hearty and undivided support.

[Since Mr. Hedley wrote the foregoing, his foundry was visited by the foundry class of the San Francisco Polytechnic High School. Through the courtesy of the instructor, the boys were asked to give their opinions of the desirability of becoming a foundry apprentice. The letters are quite frank, to say the least, and show that the foundry is not considered when the boy chooses his life work. The following are excerpts from the letters: "Even the wonderful wages of a molder as a reward for his apprenticeship will not make the boy overlook the four years of apprenticeship." "It is true that a boy with a high-school education wants to make more of himself than a mechanic." "The boys that go to a foundry are offered a hard job and small pay, so he goes elsewhere, gets better pay and easier work." "If you stay four years you become a journeyman, your pay increases, but your work is just as hard. When the average man gets over fifty or sixty he cannot do hard work and then where can he get, knowing only foundry work?" "Advancement is not to a high enough degree, being only a position of manual labor." "Foundry work, I imagine, is a detriment to good health and the danger is very great." "Still there are advantages after he becomes a journeyman. He may become a foreman, but still it isn't such a wonderful position for a man who trained such a long time for it." "When a boy comes to a Polytechnic, it is not his idea to learn a trade but rather a profession." "The majority of men with brains have other ambitions and do not wish to be old men at forty, as the average foundryman is." "While working as an apprentice a man gets hardly enough to have a decent living as everything is so high in price." "The three years of apprenticeship is just like going to sleep for three years, because if you ever decide to quit the molding trade there is just that much of your life wasted." "A boy with any head would like to get a place where there is less manual labor than in a foundry." "The only future you could look forward to is owning your own shop some day, but by the time you had saved enough to buy and equip it, you would be nearly worn out." "After a boy goes to high school four years he does not like to work in a foundry for four more years serving his time as an apprentice for $30 or $40 a month. A boy, when he gets out of high school, wishes to go to work where he has a good chance to rise and amount to something." "A molder is looked down upon, for as a rule he is not educated.'—EDITOR.]

Let the Seller Beware

At one of the markets in town can be seen daily a man selling soap for a livelihood. He is blind. Some years ago he started a small foundry. He was a journeyman-molder with no business education and no idea regarding costs. He thought he could 'produce castings for one-half the price' of the larger and older plants. He secured business from some of the largest shops. The purchasing agents knew this man was losing money on every order, but they took advantage of his ignorance.

At the time this man was producing castings at less than cost, the local charities were putting shoes on his children's feet, and clothes on their backs so that they could attend school. At last he was hopelessly in debt. He owed the supply-houses, he owed the scrap-dealers, and he owed his landlord. He was closed out, and about the same time his eyes began to fail.

The men who bought castings from him knowing all the time that he was losing money would have been shocked at the suggestion that they could make some money by breaking into his shop and robbing the safe. Probably, had they been selling supplies, they would have spurned the idea of selling him inferior goods for the price of superior ones, although this is by no means so certain. Yet, essentially, all three actions are equally dishonest. We are rapidly getting away from the old motto of 'Let the buyer beware.' Is it not about time that 'Let the seller beware,' also went into the discard?

A spoofer is a man who has just invented a patent corkscrew.

A ship just launched at one of our local yards is named the 'West Cactus'. Hailing this boat would be like calling a pup named 'Euripides'.

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The Saturday Half Day

By MR. DROOLY

"I SEE by the paapers, Cassidy, that th' cost av' high living must be goin' down, because a feller don't have to work so long every week as he used to."

Mr. Drooly shook his paper and peered over his glasses solemnly at Cassidy who was placidly smoking and watching those passing in the street.

Cassidy removed his pipe and said "How's that Mr. Drooly; I havn't seen anny thin sellin' lower and what wid th' price av th' GRUB an' th' CLOTHES goin higher awl th' time a man has to scratch to keep things movin', an' as fast as he makes more, somethin' goes up to take it away from him but what's in th' paapers, Mr. Drooly, to make ye think its goin' down."

"Well Cassidy, theres been a meetin av th' Metal Trades from th' north in MY CITY OAKLAND thryin' to make this part av th' counthry similiar like to what is up there, and among a lot av things they have decided not to work av'a SATURDAY AFTERNOON at all, at all, but instead av gettin six forty fer six days' work they are figgerin on workin only five and wan half days ivery week at higher pay."

"Mr. Drooley, how does that give thim fellys any more dollars to beat this here high cost av' livin'; they work less av coorse, but th' don't get paid fer it, an where does it come in at."

"Cassidy, I'm surprised at ye; a perfectly good HOD CARRIER that ye are, cant ye see that th' first thing to do is t' get th' half day off av a Saturday widout pay and wid double time fer overtime, and then's th' time to start to get more money ivery day, so as to be more than th' old wage was fer the full week; and then if things shud get busy, Cassidy, real busy, ye know, there's th' overtime rates to take care av th' extra GASOLINE and et so forth."

"Well Mr. Drooly, that's awl right, av coorse; we have had that in th' BUILDIN' TRADES fer a long time, and its a great scheme provided, Mr. Drooley, that theres any BUILDIN' goin on fer the five and a half days av' th' week, and thats th' trouble, there's so manny things that cost more, what wid HIGH WAGES and SHORT TIME, an waitin fer th' galvanized-nail drivers' union to drive th' seven galvanized-nails holdin' on th' weathercock, befure th' roofers can git at it, ye see awl this makes th' HIGH COST AV' BUILDIN' so high that there AINT NO BUILDIN', and we're sittin around an doin' odd jobs until some wan'll see it and give us a chanst to "PLY OUR TRADE" as th' professer sez."

"Cassidy, ye've GOT TH' IDEA, and it's a wonder ye wudden't be out movin' around, and tellin' 'em a few things about what makes th' high cost av iverything instead av sittin around and waitin fer resolutions from conventions that'll find ye a job; provided av coorse, Cassidy, that th' resolutions will make th' public GET BUSY AND BUILD; an another thing I'm tellin' ye Cassidy; th' same thing is every where; it's th' high cost av sellin GROCERIES, th' high cost av CASTINGS, th' high cost av MACHINE WORK, th' high cost av' POSTAGE; th' high cost av' BANQUETS; th' high cost av doin annythin', and then agin, Cassidy, there's a lot av bull-headed guys in Germany that's thinkin about th' HIGH COST AV WAR; so there ye are, Cassidy, and wid it awl now, how can ye ixpect a felly that's got a dollar or mebbe two or three, to go out and buy a lot av things that help to make PAY ROLLS; when awl he's got to do is to sit tight an wait fer things to go down."

"But, Mr. Drooly, didn't th' PERFESSERS till us manny a time, an' ain't they still tellin us; that LABOR should share the greater part av PROFITS wid th' EMPLOYERS, Mr. Drooly, an when will that start do ye think."

"Well, now, Cassidy, as to that I can't say, but it wuddn't be th' first time th' perfessor fellies has got ye in wrong, me bye; an there's wan sure thing ye mustn't forgit, Cassidy, and that is that manny a man can get up a lot av dandy SCHEMES to separate some wan ilse from his pocket book; and then again if things got so bad, Cassidy, that some wan wud complain av th' high cost av EDUCATION, ye see they wuddn't have th' same ideas, Cassidy."

"Mr. Drooly, I want to ax ye WAN QUESTION just wanst and that is, what is the answer."

"Cassidy, I hate to say it to ye, but I'v thought it awl out and I'm not a graate man, Cassidy, though I will admit that me father was th' greatest and the grandest officer an th' beat; whats th' answer ye say, now ye listen to me, Cassidy, and ye put this in yer pipe and smoke it, th' SATURDAY HALF DAY, and lots av th' other half days and full days is only another way to get out av workin', and th' throuble wid awl this high-cost stuff that ye are hearin about is that NOBUDDY WANTS TO WORRK ANNY MORE, th' BOSS wants to PLAY GOLF, th' girls want to go to th' MATINEE; th' BOYS wants to go FISHIN'; th' MEN want to LOAF, even th' BANKERS want MORE HOLIDAYS, and wid NOBODY WANTIN TO WORK, of coorse things COST MORE, an' th' only ANSWER is that ivery wan had got to sphit on his hands and grab hold av things again, an' "GET TO WORK" widout any ARGUIN' or RESOLVIN' or FUSSIN' around about WHO'S GOIN' to DO IT, Cassidy, an' that means th' BOSS, an' th' PERFESSER, an' th' WORKMAN, an' even th' LAWYER guy, Cassidy, and when that happens an' not before, ye will see ivery man HAPPY an' PROSPEROUS, Cassidy."

"Well, Mr. Drooly, I hope ye are right, and I believe I'll sthart in on th' scheme by SWEEPIN aff th' FRONT STHEPS fer th old woman so, good night, to ye."

"Good Night Mr. Cassidy."

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Book Reviews

Making the Small Shop Profitable. By John H. Van Deventer. Pp. 110, ill., index. The McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $1.75.

This book comprises articles and other material from 'The American Machinist'. Machine-shop practice and allied subjects from pattern-making to painting the completed device are discussed, with particular reference to the small shop. About half the book is devoted to sketches of various 'shop kinks'.

Examples in Magnetism. By F. E. Austin. Pp. 86, ill., index. F. E. Austin, Hanover, N. H. For sale by 'Mining and Scientific Press'. Price, $1.10.

While this book is primarily intended as a textbook for the student it will also be useful to the engineer. The introductory part of the book discusses weights and measures as applied to magnetic problems and also gives a brief review of trigonometry in so far as it concerns these same problems. The remainder of the book is devoted mainly to the statement and demonstration of the principal magnetic propositions illustrated by examples.

Introductory Mathematical Analysis. By W. Paul Webber and Louis Clark Plant. P. 299, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $2.

This book was written for a college textbook, and this will constitute its principal field of usefulness, although the engineer that has forgotten his college mathematics may be able to use the book as a means of refreshing his memory. The first two chapters constitute a brief review of elementary algebra and geometry. The book then deals with co-ordinates, trigonometry, vectors, conic sections, series, and differential and integral calculus.

Gasoline and Kerosene Carburetors. By Victor W. Page. Pp. 206, ill., index. Norman W. Henley Publishing Co., New York. For sale by 'Mining and Scientific Press'. Price, $1.50.

Where one man was interested in carburetors twenty years ago, there are probably one hundred today. Furthermore, the fact that gasoline production has failed to keep pace with consumption has increased interest in the development of carburetors for vaporizing the heavier constituents of petroleum. The present volume is non-technical, and within the province of anyone with enough intelligence to run an internal-combustion engine.

Metal Statistics, 1919. Compiled by C. S. J. Trench and B. E. U. Luty. Pp. 384. American Metal Market Co., New York, 1919. For sale by 'Mining and Scientific Press'. Price, 50 cents.

This is one of the most useful of our desk references, especially as prices and production of metals are given for many years. The publishers of this annual issue what they term the 'steel and metal trio'—the 'American Metal Market', daily; the 'Steel and Metal Digest', monthly; and 'Metal Statistics', yearly. Any one wishing to learn anything about any of the metals will find it in this work, also a long list of manufacturers and dealers.

Essentials of Alternating Currents. By W. H. Timbie and H. H. Higbie. P. 360, ill, index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $1.60.

This book is written with the needs of men having little training in higher mathematics in mind, and will be useful to them as a text and reference book rather than to college-trained engineers. The chapter-headings are as follows: Modern Systems of Power Transmission; Power Factor; Current and Voltage Relations in Series and in Parallel Circuits; Polyphase Circuits; Calculation of Wire Sizes; Motors, Starters, and Controllers. An appendix contains a number of useful electrical tables. The book is well illustrated. At the end of each chapter there is a brief summary of the important points discussed, which would be of great assistance to the student in reviewing.

Galvanizing and Tinning. By W. T. Flanders. Pp. 312, ill., index. David Williams Co., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $4.

This is a complete revision of the author's earlier work on the same subjects. In this he has had the assistance of several men that are authorities on certain special processes. The first chapter contains a general discussion of corrosion and its prevention, and then comes a description of hot-galvanizing plant and equipment, including pyrometers. The author then considers materials used in galvanizing, also preparing work for galvanizing, including pickling, water-rolling, tumbling, and sand-blasting. Then come several chapters devoted directly to the hot-galvanizing process. The Schoop 'metal-spray' process is then considered. Then come several chapters on tinning, and following that a discussion of electro-galvanizing. Sherardizing is then considered. The final chapter is devoted to galvanizing specifications and tests. The book is well-illustrated and will be of value to anyone interested in the subjects discussed, whether as a manufacturer or as a consumer of galvanized and tinned products.

Handbook of Mechanical and Electrical Cost Data. By Halbert P. Gillette and Richard T. Dana. Pp. 1716, ill., index. For sale by 'Mining and Scientific Press'. Price, $6.

As the preface states, this book is intended as a companion volume to Mr. Gillette's 'Handbook of Cost Data', and Mr. Dana's 'Handbook of Construction Plant'. The arrangement is similar to the former book, but there is little overlapping. In these days of abnormal prices, and of discussion as to whether or not large reductions will be made in the near future, some engineers and estimators may feel that a book of cost data, since its costs manifestly cannot be brought up to the minute, is of slight value. That this viewpoint is erroneous, provided the cost analysis is accurate and complete, is shown by the authors in the introductory chapter. The completeness of the book may be judged from the chapter-headings, which are as follows: General Economic Principles; Depreciation, Repairs, and Renewals; Buildings; Chimneys; Moving and Installing; Fuel and Coal Handling; Steam Power; Internal-Combustion Engines and Gas-Producers; Hydro-Electric Plants; First Cost and Operating Expenses of Electric Plants; Overhead and Underground Electric Transmission; Wiring; Drives; Compressed Air; Gas Plants; Pumps; Conveyors, Hoists, etc.; Heating, Cooking, Ventilating, Refrigerating; Electric Railways. The book is an excellent reference.

Office Administration. By J. W. Schulze. P. 290, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientfic Press', San Francisco. Price, $3.

Office managers and office clerks believing that scientific management would not affect them, that their work was 'different', have been living in a fool's paradise. The present volume is one of several appearing recently that discuss wastes in office operation and methods of promoting office efficiency. The principal subjects discussed are selection and

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training of office workers, office layout, establishment of routine processes, filing systems, order and billing systems, handling correspondence, and general office service. The discussion is illustrated by reference to methods actually used in many offices. While a number of these methods are suitable only for offices where hundreds or even thousands of clerks are employed, the manager of the small office will find many helpful suggestions. The weak point about the book is its almost total neglect of the human factor. The reader frequently pauses to wonder how some of the proposed systems would actually work when applied not to automatons, but to real live employees, who could quit if they wanted to do so, and get a job somewhere else. Some idea of this neglect of the human factor may be obtained from the fact that the chapter on the relationship between the employer and employee contains only six pages. Not that there is not plenty of space devoted to training and handling employees. There is, but the discussion is of exactly the same character as that regarding office furniture. Nevertheless, with these reservations, the book has a considerable value for the employer and the office manager.

Scrap Metals. By George H. Manlove and Charles Vickers. Pp. 278, index. The Penton Publishing Co., Cleveland. For sale by 'Mining and Scientific Press'. Price, $2.

The scrap-metal industry, like so many others, was unheralded and unsung until the War directed the public attention to its importance. The present volume is the first we have seen that is devoted entirely to this industry, which handles nearly one billion dollars worth of material each year. The first part of the book, by Mr. Manlove, is devoted almost entirely to iron and steel scrap, and discusses not only the scientific principles governing its use in blast-furnace, steel plant, and foundry, but also the principal sources and kinds of scrap and the methods of marketing and of financing the scrap industry. As the book was written while Government control of the industry was still in force, considerable space is devoted to this topic. The appendixes contain the principal classifications and specifications for scrap. The second part of the book, by Mr. Vickers, is devoted to the non-ferrous scrap metals, taking up each class of metal and alloy in turn, and showing how the various articles may be sorted in order to give the best results in the furnace.

Graphic Methods for Presenting Facts. By Willard C. Brinton. Pp. 363, ill., index. The Engineering Magazine Co., New York. For sale by 'Mining and Scientific Press'. Price, $5.

The man that said, "There are three kinds of lies, plain lies, damned lies, and statistics," probably had in mind, in part at least, the benumbing effect upon the brain of the average reader of a long line of figures with no means provided of properly correlating them. The fundamental idea of graphic methods is to assist the mind in visualizing the facts expressed in statistics. Yet, even here, as the author shows, care is needed, or the purpose of preparing the charts will be defeated. The book deals with the various kinds of graphic representations, including plain figures and diagrams, curves, maps, and combinations of these methods. The applications of the various methods to the domain of the engineer, the business man, the manufacturer, and the lawmaker are then discussed, particular attention being paid to the use of graphic methods for making company reports more intelligible to the average stockholder. The two final chapters are devoted to a discussion of the general methods of preparing graphical data and to the errors to be avoided in doing such work. The treatment of the subject throughout is non-technical, and makes no use of the higher mathematics. There are over two hundred illustrations showing various applications of graphic methods.

The Turnover of Factory Labor. By Sumner H. Slichter. Pp. 442, index. D. Appleton & Co., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $3.

For centuries employers have been 'hiring and firing' and complaining of the cost of breaking in new employees without making any direct attempt to study labor turnover and the possibility of its reduction. In recent years, however, there has been considerable investigation and discussion of this subject. The present volume is probably the most complete that has appeared and presents the results of several years study. Most of the data given are for years preceding 1916, thus eliminating abnormal war conditions. The book first considers the various ways of expressing and measuring the turnover and then its classification under resignations, lay-offs, discharges, and miscellaneous causes. The effect of various factors on the size and rate of the turnover is then considered. Next comes the cost of turnover, both to the employer and employee. Turnover is then analyzed according to causes, the subdivisions being causes pertaining to the job, causes arising from relations between the men and the management, causes pertaining to the men, and causes pertaining to better opportunities elsewhere. The remainder of the book, about half, is devoted to methods of reducing turnover, based mainly on what certain firms have actually accomplished. While the book will appeal to the sociologist, it is thoroughly practical.

Man to Man, the Story of Industrial Democracy. John Leitch. Pp. 249. B. C. Forbes Co., New York. For sale by 'Mining and Scientific Press'. Price, $2.

'Industrial Democracy' is a term that means many different things, varying according to the person using it. To the author of this book, who has established such systems in many factories, it means a system having the following general features: A plan of factory government modeled after the Federal system with a cabinet composed of the executive officers of the company, a senate composed of the foremen and minor executives, and a house of representatives elected by the rank and file of employees. Wages and other working conditions are determined by these bodies. The cabinet has veto power, but the experience of the author is that this power is seldom if ever used. A share in the profits, the author believes should be given to the employee, but he disapproves of most of the ordinary plans of profit-sharing, particularly because they do not furnish sufficient incentive. Instead he favors a system based not on profits, which are affected by many things entirely beyond the workers' control, but on output and on cost of output, sharing all saving in cost of production with the employee. He does not believe that the employee should have a voice in matters other than factory policy. The book is mainly devoted to a description of various plants where such a system of factory government has been adopted with satisfactory results, with the significant statement that in only two instances have the results been unsatisfactory, both of these directly traceable to failure on the part of the management really to give their employees a voice in factory government. The author is, perhaps, not sufficiently clear on how such a plan can be worked out under unionized conditions. Apparently, it presupposes an open shop. While an instance is given where an attempt to unionize an 'industrial-democracy' plant was successfully resisted by the employees themselves, although a majority of them were union men, no suggestions are offered as to the method to be pursued to bring the adoption of the plan in a union shop working under a collective-bargaining agreement. Nevertheless, when the author presents evidence of plant after plant where the adoption of industrial democracy has caused increased output, better working conditions, better feeling on the part of employees, and better wages to employees, the thing is certainly worth investigation.

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Trade Notes

D. P. Johnston, representing the **Union Drop Forge Co.** of Chicago, has opened an office at 201 Balboa Bdg., San Francisco.

The Pacific Tank & Pipe Co. furnished all the tanks, tubs, and woodwork for the new plant of the Remar Baking Co. at Berkeley.

An election will be held at Porterville on June 30 to vote on a bond issue of $200,000 for the construction of a municipal gas-plant.

Henry M. Robinson, of Pasadena, has been appointed a member of the U. S. Shipping Board, succeeding **Charles R. Page,** who resigned.

The Moore Shipbuilding Co. has commenced work on a 20,000-ton drydock and two marine railways at its plant on the Oakland estuary.

The shipbuilding plants of the **Foundation Co.** at Portland, Tacoma, and Victoria are to be dismantled and the machinery shipped to France.

The California Cedar Products Co. is constructing seven reinforced concrete buildings for its plant at Stockton. The company will employ about 200 men.

The Los Angeles Shipbuilding & Drydock Co. has commenced work on a 10,000-ton drydock at the Los Angeles harbor. The estimated cost is $2,000,000.

District offices for the **Chamber of Commerce of the United States** have been opened in the Merchants Exchange Bdg., San Francisco, in charge of **Paul Clagstone.**

The San Joaquin Light & Power Co. has commenced work on a $2,500,000 power-plant on the San Joaquin river near Auberry. About 28,000 hp. will be developed.

Contract for construction of 35 elevators at the Union Terminal warehouse at Los Angeles has been awarded to the **Baker Iron Works.** The estimated cost is $200,000.

Calvert Townley, assistant to the president of the Westinghouse Electric & Manufacturing Co., has been elected president of the American Institute of Electrical Engineers.

Benjamin G. Lamme, chief engineer for the Westinghouse Electric & Manufacturing Co., has been awarded the Edison medal for invention and development of electrical machinery.

The Oakland Technical High School has purchased from the **Herberts Machinery & Supply Co.** a 20-in. Cincinnati shaper, three Rockford Economy lathes, and a large Racine motor-driven power-saw.

The Southern California Edison Co. has purchased the property of the **Flume & Irrigation Co.** at Shaver, Fresno county, and will spend $8,000,000 on hydro-electric development in that vicinity.

The Southwestern Drydock Co., a subsidiary concern of the Southwestern Shipbuilding Co., of Los Angeles, has commenced work on a large drydock at Los Angeles harbor. The estimated cost is $1,000,000.

The members of the **San Francisco Association of Members of the American Society of Civil Engineers** visited the Mare Island Navy Yard on May 24 as the guests of Captain Edward L. Beach, commandant of the Yard.

The Beckman & Linden Engineering Corporation is installing a 100-kw. electric furnace at its research laboratories at 41 Minna street. This furnace is to be used for making investigations of electric-smelting problems.

The oil-pumping equipment at the Union Oil Co.'s new refinery at San Pedro was furnished by the **Kinney Manufacturing Co.** The installation consists of 12 Kinney rotating-plunger pumps. Six of these have a capacity of 350 gallons per minute at a working-pressure of 250 lb. per square inch, and the other six have a capacity of 150 gallons per minute.

The Judson Mfg. Co., of Emeryville, is building a tripper tower which it expects to have in operation in about a month. This is a device for passing the ingots out of the mold and is the first to be installed on the Pacific Coast.

The Cleveland Milling Machine Co., of Cleveland, has issued circulars on its plain and universal milling machines and its dividing-head attachment. Copies of these circulars, also specifications may be obtained by writing to the company.

Deterioration from corrosion and exposure to the weather can be greatly reduced by painting. **Oronite paint** can be used to advantage on buildings, fences, many kinds of machinery, smoke-stacks, pipe-lines, and for many other purposes.

The annual picnic of the employees of the **Holt Manufacturing Co.** was held on May 24. In the evening a 'Safety First' motion-picture film prepared under the direction of the Industrial Accident Commission of California was exhibited.

The Alumni Association of the University of California has established a 'Bureau of Occupations' for graduates and former students. No charge is made to either employer or employee for this service. Headquarters have been establishd at 201 California Hall, Berkeley.

The White Foundry Co., of Stockton, has received permission from the State Commissioner of Corporations to issue stock. The principal stockholder is H. C. White, formerly factory manager for the Holt Manufacturing Co. and also factory manager for the Harris Manufacturing Company.

Sherer & Crowley, of Los Angeles, have been awarded a contract for the construction of a reinforced concrete dam and headgate on the Gila river at Gila Bend, Arizona. The work is for an irrigation project and includes the repair of about 40 miles of main canal. Estimated cost is $695,000.

Two Government dredging contracts have recently been awarded to local firms. Contract for dredging at the entrance to Petaluma creek has been awarded to the **United Dredging Co.** for $28,464, and contract for dredging in Oakland harbor has been awarded to the **San Francisco Bridge Co.** for $87,480.

The San Francisco Chamber of Commerce has elected the following officers for the ensuing year: Atholl McBean, president; Wellington T. Smith, first vice-president; Robert Newton Lynch, second vice-president and manager; George C. Boardman, third vice-president; L. M. King, secretary; Stuart F. Smith, treasurer.

The U. S. Ball Bearing Co. maintains an engineering department at its offices in the Rialto Bldg., San Francisco. The engineering staff is equipped for making tentative layouts and designs to assist manufacturers in selecting the right type of ball-bearings for their particular needs. **F. D. Kyle** is the Pacific Coast manager.

W. P. Brown of **Brown Bros. Welding Co.,** San Francisco, leaves early in June on a six weeks' trip through the Eastern States. In New York he will join **J. H. Janusch,** quarterman welder at Mare Island Navy Yard, who is making the trip in his Franklin car. Together they will visit the leading manufacturing districts in search of new ideas in welding practice.

Rufus A. Freeman, representing the **Rotary Scraper Co.** of New York, has opened an office at Room 1100, No. 1 Drumm street, San Francisco. This company manufactures a device consisting of a motor and a flexible shaft to which can be attached a grinding wheel, wire brush, or other tools. The principal use of the device is cleaning iron work for painting. For this purpose it is said to take the place of 10

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men working with a chipping hammer or two men with a pneumatic tool.

The Union Gas Engine Co. of Oakland is manufacturing a flying-boat for J. B. Struble of the Union Switch & Signal Co. This boat is a two-seater and has practically the same design as the one that the Union company built some time ago and used so successfully in testing its new types of aeroplane motors. The new boat will be equipped with this motor.

The Hyatt Steel Products Co., Ltd., of Granville Island, British Columbia, has acquired the plants of the Canadian Metals, Ltd., Tudhope Electric Metals, Ltd., and the Port Moody Steel Rolling Mills. At the Tudhope plant there is a 6-ton electric furnace making steel and low-phosphorus pig-iron. The new company intends to make ingots at the Tudhope plant and to roll them at the Port Moody mills.

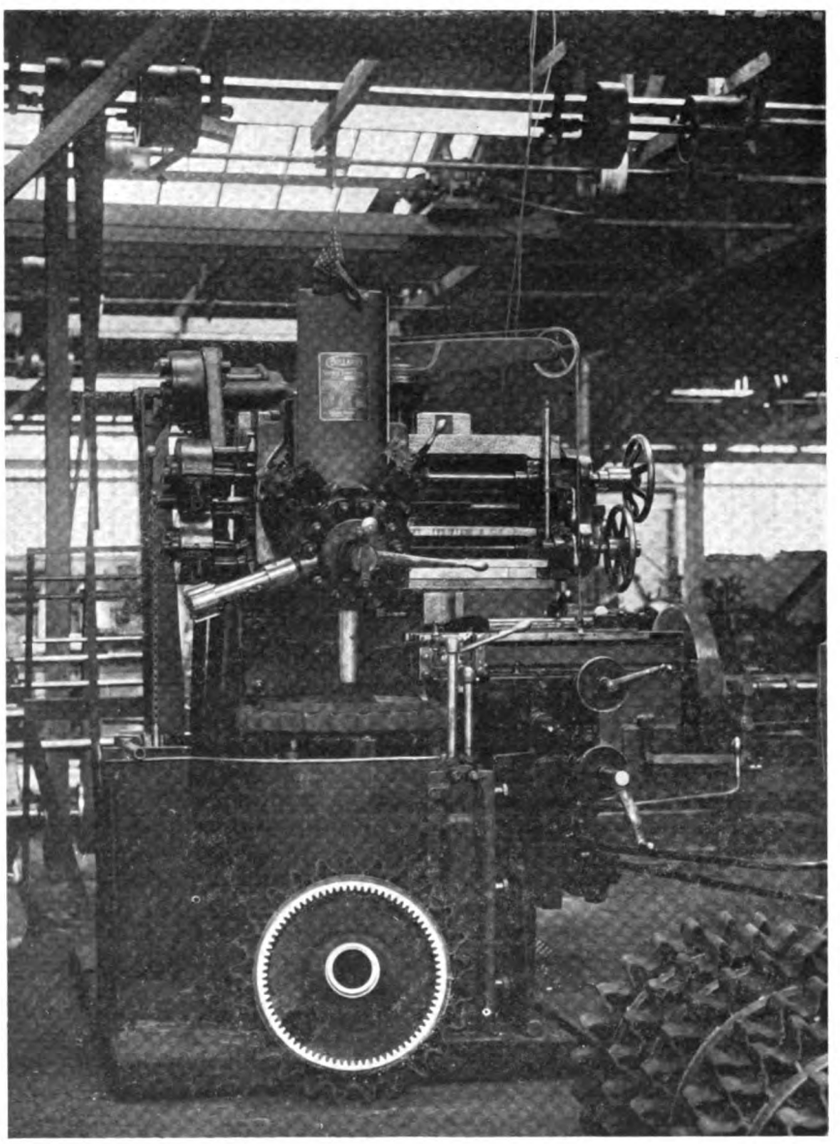
The Pacific American Steamship Association, composed of shipowners in all lines on the Pacific Coast except the lumber-carriers, was recently organized at San Francisco. The officers are Robert Dollar, president; A. F. Haines, first vice-president; Daulton Mann, second vice-president; F. A. Hooper, secretary; F. Samuels and S. C. Saunders, directors. A committee composed of H. W. Poett and Henry Struthers was appointed to go to Washington and confer with the U. S. Shipping Board regarding the future of Pacific Coast shipping.

The American Institute of Mining and Metallurgical Engineers will hold its convention in Chicago, September 22 to 26. This meeting promises to be one of importance to the industry, as subjects of importance in metallurgy will be considered. In addition to the technical discussion, excursions are planned to many points of interest in the vicinity, including the steel-mills at Gary, the oil-refineries at Whiting, the metallurgical plants at East Chicago and North Chicago, and the LaSalle district, where the cement, coal, and zinc industries are represented.

John R. Brownell, superintendent of safety for the California Industrial Accident Commission, has resigned to take a position with the Equitable Life Assurance Society in San Francisco. Mr. Brownell will make a specialty of group and business insurance. He will be succeeded by **Hugh M. Wolflin,** chief mine inspector for the Commission. Both Mr. Brownell and Mr. Wolflin have been with thesafety department of the Commission since its formation in January, 1914. **G. Chester Brown** takes Mr. Wolflin's place. **T. W. Osgood** has been appointed superintendent of safety for the Los Angeles district.

The Western Brass Manufacturing Co., 217 Tehama street, has obtained the rights for the Parker process of rust-proofing iron and steel. This process, which is used extensively throughout the East, gives a dull black finish that is attractive for machine parts and tools. Many of the parts for the Underwood typewriter are 'Parkerized'. The Packard and Cadilac automobile companies both have large Parker plants and rust-proof many of the exposed parts. Fenders are 'Parkerized' before enameling so they will not show rust streaks wherever there is a scratch. The Federal government found this process much superior to nickel-plating or other processes on parts exposed to salt water, such as the submersion-valve springs on submarines. There are 'Parkerizing' plants at several of the navy yards. Many parts of the Eagle boats were treated by the process. It consists of pickling in a chemical bath at a temperature of 210°F., which is not hot enough to effect the temper of springs or tools. It produces an oxidized finish one to two-thousandths of an inch thick, which does not interfere with the assembly of finished parts. One of the advantages of the process is its relatively small cost.

The accompanying illustration shows a 42-in. Bullard vertical-turret boring-mill at the plant of the **C. L. Best Gas Tractor Co.,** San Leandro. It is shown machining a cast-steel track-sprocket, the work for which it was purchased. The work was formerly done on a horizontal mill but the new mill does the work a great deal faster, the particular advantage being that it is much easier to chuck. The first operation is to chuck with the universal chuck, then it is rough and finished bored with the turret and at the same time the rim is turned with the side-head. It is then reamed with the floating reamer and then the counterbore on the outside of the hub is rough and finish turned



Vertical-Turret Boring-Mill

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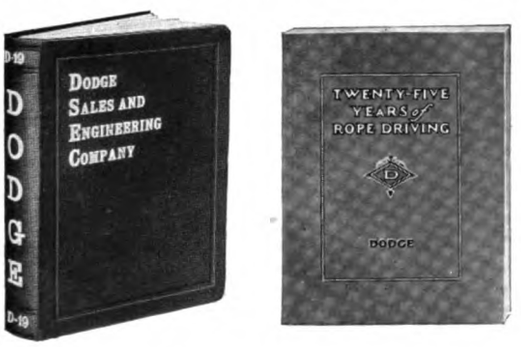
with the tool shown on the upper side of the turret. The entire machining of the sprocket is accomplished in one set-up. The machine is a multi-purpose tool that is adaptable to a great variety of uses as it has many structural and operative features that make it useful in machining face-plate work. The Bullard company has issued a 95-page descriptive catalogue of this mill entitled 'Cutting Time Between Cuts', which not only describes the mill and its adjustments and operation but also shows many examples of the work the tool is capable of doing. The catalogue may be obtained through Harron, Rickard & McCone, Pacific Coast agents.

'Twenty Five Years of Rope Driving' is the title of a 100-page catalogue issued by the **Dodge Manufacturing Co.** describing its American System of Rope Driving. In this system one continuous endless rope is used, winding around the sheaves successively in several grooves making as many complete wraps as may be required by the power to be transmitted. From the last groove on the driving-sheave the rope



passes over single-groove tension and winder idlers which direct it to the first groove of the driven pulley and also control and regulate the tension in the rope throughout the drive. The other or English driving system consists of a number of endless ropes, which depend entirely upon gravity for tension, the same as a belt. The catalogue is illustrated with photographs of a great variety of installations. Much valuable information is also given regarding power transmission by rope-drive.

A device that successfully drills hexagonal holes is shown on page 251. This is used by the **Drake Lock-Nut Co.** in making a jig to hold the lower member of its lock-nuts while the slots are being milled. The drill can be used in an ordinary drill-press. The device resembles a universal joint, and transmits the power to the drill while allowing it to 'float'. To drill a six-sided hole, a five-pointed bit is used. Unlike a reamer, the bit is sharp only on the end and not on the sides. It is used with a guide, which is clamped to the work. In operation the five-sided bit floats in the six-sided guide, all the points being in contact with the guide. When two of the points are approximately in the middle of the sides of the guide the opposite point is forced into the angle. After the guide is clamped to the work the hole is drilled as rapidly as with an ordinary drill. In making the jig-plates shown in the illustration, round holes were drilled first to make it easier to fasten the guide to the work. The guide is also shown with the drill in it. The round holes are used to bolt it to the work. The drill is manufactured by **Watts Bros.**, Turtle Creek, Pennsylvania, who also manufacture drills for square holes.

Fred C. Metcalf, Secretary of the California Metal Trades Association, returned May 17 from a month's trip through the manufacturing centres of the East, including New York, Boston, Hartford, Bridgeport, Philadelphia, Cleveland, Detroit, and Chicago. While in New York city, he attended the annual convention of the National Metal Trades Association. Mr. Metcalf reports that the general business conditions are rather quiet, due to cancellation of war contracts and uncertainty regarding legislative action. The labor market is rather easy with working forces of most concerns reduced quite materially. Unemployment, however, is mostly among unskilled labor and semi-skilled war workers. A general unrest among the laborers is apparent. Agitators are taking advantage of this condition to foment strikes, I. W. W.'ism and Bolshevism. Employers are meeting the situation firmly as a rule, but many of them are studying and introducing in their plants plans for shop representation and are making investigations in industrial democracy. Wages are generally lower than on the Pacific Coast and there has been a slight decrease in most trades from the war scale. Shop conditions are different from here with piece-work or else a premium or bonus on production generally in effect, so that the total earnings of skilled men are about the same in the East as in the West. Hours are being reduced to some extent although the majority of firms still work on the 50-hour per week basis. Because of the business depression, many firms have introduced the five-day week, and some are only working four days without, however, reducing the number of hours worked per day. Many firms close Saturday noon, and some Friday night but all work is upon a nine or a ten-hour basis. Mr. Metcalf did not find any 44-hour per week basis in the East among manufacturing firms.

Market Review

While it is difficult to place one's finger on any actual improvement either in demand or in prices, there is a generally healthier tone to the metal markets than was the case last month. With the resignation of the Industrial Board, all thought of Government regulation has vanished, and the market is now on a demand-and-supply basis. The U. S. Railroad Administration has awarded, 'under protest', contracts for furnishing 200,000 tons of open-hearth rails at $47, which was the price fixed in March, and which was the principal subject of disagreement between Mr. Hines and the Industrial Board. In general, the price-schedule adopted at that time is the prevailing one, although sales are occasionally made at slightly-shaded prices.

The local iron and steel market is unsettled but shows light improvement. Prices are stiffening perceptibly, although relatively few sales are being made. Warehouse prices are unchanged.

Some improvement is noted in the local scrap market. The steel mills are doing more buying than for some time, and while a price for steel scrap can hardly be said to have been established, demand has improved considerably. No. 1 cast-iron scrap remains at $37.50 per net ton. Reports from Seattle and Portland give the approximate prevailing prices in that district as $30 for cast-iron scrap and $12 for steel.

Demand for most of the non-ferrous metals has increased noticeably, and this has had its effect upon prices, which are as follows at the end of the month:

Copper	17.00
No. 1 red ingot brass	16.00
No. 1 yellow ingot brass	12.00 to 13.00
Electrolytic zinc	9.00 to 9.25
Prime Western zinc	8.50
Lead	5.75
Antimony	8.75

There have been few sales of old metals, and these were at widely fluctuating prices.

WANTED—Brass foundry foreman capable of handling a small shop in Los Angeles. Attractive proposition to man thoroughly competent to take complete charge and turn out sound, first-class castings. Address D. C. Conover, 386 Pacific Electric Bdg., Los Angeles, Cal.

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